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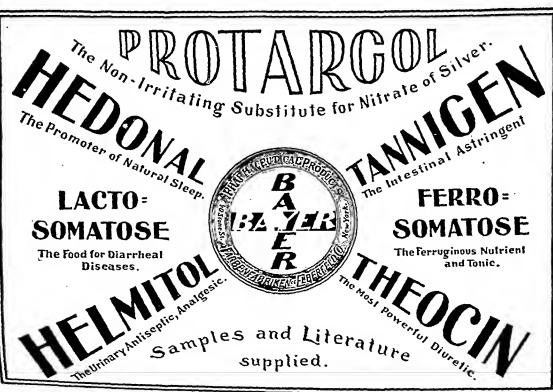
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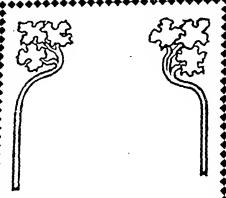
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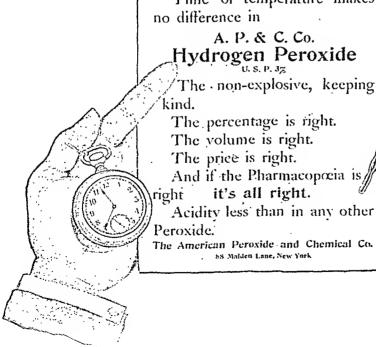
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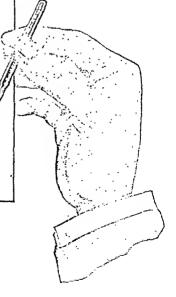
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A CASE OF GUNSHOT WOUND OF THE BRAIN IN WHICH THE ROENTGEN RAYS SHOWED THE PRESENCE OF EIGHT FRAGMENTS OF THE BULLET; LOCALIZATION BY SWEET'S METHOD MADE OPERATION INADVISABLE.

WITH A DESCRIPTION OF AN IMPROVED APPARATUS FOR LOCALIZATION OF FOREIGN BODIES.

BY W. W. KEEN, M.D.;

AND

WM. M. SWEET, M.D., OF PHILADELPHIA.

DR. KEEN'S REPORT OF THE CASE.

THE following case is put on record as an excellent illustration of the inadvisability at times of removing a foreign body from the brain, and also of the probable rebound of a ball from the inner surface of the skull:

Clarence P., aged fifteen years, of Victoria, B. C., first consulted me on April 9, 1903, at the instance of Dr. O. M. Jones, of Victoria, and

of Sir Victor Horsley.

On October 24, 1902, he accidentally shot himself with a 22-calibre rifle. The bullet entered the right side of the forehead a half-inch above the eyebrow at the junction of the middle and external thirds. Dr. Jones saw him half an hour after the accident occurred, and found brain matter and blood oozing from the wound. The boy was collapsed and complained of numbness in the left leg and foot, but could move them. He was taken to a hospital, anæsthetized, the wound enlarged slightly, thoroughly cleansed, and an antiseptic dressing applied. The opening in the bone readily admitted the tip of the forefinger. Several small splinters of bone were removed, and from under the skin, about one inch above the opening in the bone, a sliver

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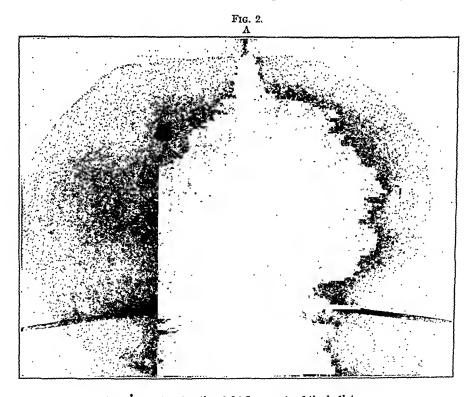
of the bullet was removed. The weight of a similar unused bullet is 29½ grains. The sliver weighed 5½ grains. The eight remaining pieces together, therefore, weigh 24 grains; the largest piece prob-



The upper figure is that of a similar bullet to the one causing the accident (weight 29½ grains); the lower figure is the sliver removed from under the skin above the wound of entrance (weight, 5½ grains). Both are natural size.

ably weighed about twenty grains (Fig. 1). Dr. Jones, wisely, did not probe for the bullet.

At the end of two or three days after the accident the left leg became entirely paralyzed. The first night he was extremely restless,



Skiagraph showing the eight fragments of the bullet.

with frequent involuntary movements of the right leg and arm, and on the day after the accident he had half a dozen very severe epileptiform convulsions, which ceased after a few doses of chloral and bromide and have not recurred. He gradually improved, never lost his intelligence, the paralysis diminished, and in the course of three months he was able to get about.

Status Præsens. April 9, 1903. There is a small scar just above the right eyebrow. No perceptible aperture in the bone can be felt. There is a little weakness still left in the left leg and foot, as shown by the fact that he balances himself unsteadily upon that foot, whereas upon the right one his balance is good. There is also some increased knee-jerk in the left leg, both with and without reinforcement.

The patient's friends in England had consulted both Sir Frederick Treves and Sir Victor Horsley in reference to his treatment. A brief synopsis of their opinions is as follows: That the position of the retained bullet should be accurately determined; that the ball is now not likely to shift its position; that it is a possible source of future irritation which might result in traumatic epilepsy, and that the advisability of the removal of the ball would depend upon its location.

Dr. Sweet then made some skiagraphs of the head, of which one is

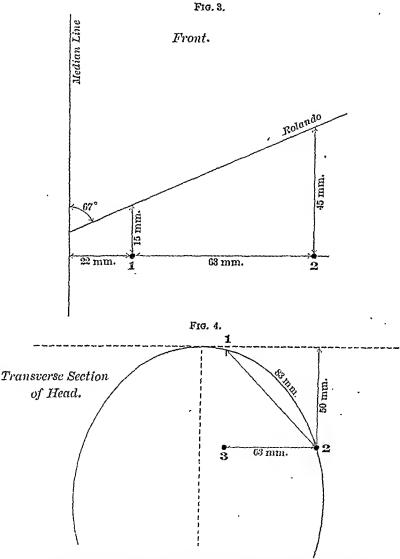
presented in Fig. 2. By his method of localization he determined the

following facts:

In the brain there are one principal fragment and seven other minute fragments of the bullet, the largest of the latter being about the size of a medium-sized pin's head. Two of these fragments are at the point of entrance. Five of them are scattered through the brain 2.5 cm. to 3 cm. above a line running from the wound of entrance to the present position of the ball. The position of each one of these fragments was precisely indicated on the scalp by Dr. Sweet.

After careful consideration of the present location of the bullet and of the boy's excellent recovery, I decided that it would be inadvisable to remove the ball. Of course, the removal of the smaller fragments was not even considered. The following were the reasons for my decision: The ball lay vertically 5 cm. below a point 2.2 cm. to the right of the middle line and 1.5 cm. back of the fissure of Rolando on a line parallel with the middle line (Fig. 3). Dr. Sweet marked not only the point on the top of the head corresponding vertically to the ball, but also a point above the ear which corresponded to it horizontally. This point was, of course, 5 cm. below the level of the top of the head, but on the curved surface of the scalp was 8.3 cm. from the middle line. It was 4.5 cm. back of the fissure of Rolando. horizontal plane from the surface of the head toward the middle line the ball lay at a distance of 6.3 cm. (Fig. 4). As it was very important that these two points corresponding horizontally and vertically to the position of the ball should be accurately and permanently marked, with a view to an accurate determination in the future whether any change in the position of the ball had taken place, they were marked in the following way: At the points which Dr. Sweet had marked upon the shaven scalp I injected a few drops of cocaine and then excised a small round piece of scalp, including the hair-follicles, so that there would be two small permanent bald spots at these points.

the boy was a very tall, well-developed lad, who had attained almost all of his growth, especially of the head, any later growth will not practically invalidate these measurements.



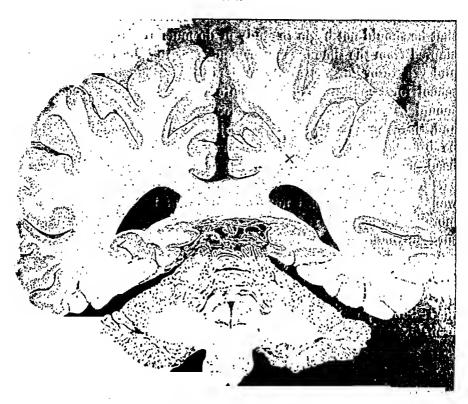
Diagrams to show the location of the largest fragment of the bullet. 1. Spot vertically over ball. 2. Spot horizontally corresponding to ball. 3. Site of ball. [Note.—The measurement 83 mm. should be from the middle line to 2, and not from 1 to 2.]

I wished then to determine the relation of the ball to the lateral ventricle, and for this purpose made a section of a brain hardened in formalin, at a point as nearly as possible corresponding to the figures given above. Comparing this with Dalton's vertical transverse sections through the brain, I found that it corresponded to Plate 15 of series C quite exactly. Applying the foregoing measurements then to this

figure, I determined that the position of the ball corresponded to the cross marked on a reproduction of this plate (Fig. 5). It will be observed that the ball lies far below the cortical leg centre and just above the lateral ventricle.

The course of the bullet was evidently not in a straight line from the wound of entrance to its present position. This is shown by four facts: 1. The boy states that at the time of the accident he was not looking directly into the barrel of the rifle, in which case the anteroposterior axis of the head would be nearly vertical, but that his head





X shows the present position of the largest fragment of the bullet.

was only moderately flexed. 2. At the wound of entrance, as the ball penetrated the bone, a considerable sliver was taken off the ball by the upper edge of the bone and lay 2.5 cm. above this wound. 3. None of the fragments, except those at the point of entrance, lie in the direct line between the wound of entrance and the present position of the ball; they all lie above this line and at a considerable distance above it. 4. If the ball had gone in a straight line from the wound of entrance to its present position, it would not have touched the cortical leg centre at all, though it is possible it might have di-

vided some of the descending fibres from the leg centre. It seems, however, much more likely that the ball passed in a line from the wound of entrance to the point A, Fig. 2, and then was deflected to its present position, and in its course traversed the cortex. It would then have injured precisely the centre for the left leg.

I decided, therefore, that it would be inadvisable to remove the ball. In its present position it is doing no harm to the leg; his paralysis has steadily diminished, and in the course of a few months will probably entirely disappear. Any attempt to remove the bullet would cause very much more injury to the brain than the bullet itself does in its present position. Accordingly I sent the patient home, with the following injunctions: First, as had been advised by Sir Victor Horsley, that he should not begin to study or do much reading until a year had elapsed from the time of the accident, and that he should then study under a tutor for a year, so as to postpone the excitement of a large school for two years from the date of the accident; second, that he should be allowed a greater degree of exercise as his leg improved; and, third, that if either of two symptoms arose he should immediately be brought back to me, viz., in case he developed persistent severe headache or any other symptoms which might suggest impending cerebral abscess; or if he should have a single epileptic attack, I should The ball then would be doing want to remove the ball immediately. more harm than the surgeon, whereas by any present interference the surgeon would do more harm than the ball.

It will be observed that at the time of the accident he had some severe epileptiform attacks, but has had none since. It is not impossible that he may never have any, and it seemed to me wiser to run the risk of a possible future epilepsy than a certain, immediate, and probably very serious damage to the brain by present surgical interference.

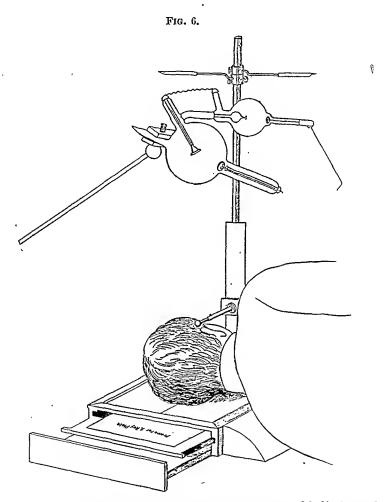
DR. SWEET'S REPORT ON THE METHOD OF LOCATING FOREIGN BODIES IN THE BRAIN AND ELSEWHERE BY THE X-RAYS.

The methods employed in locating foreign bodies by the Roentgen rays are all based upon the triangulation of the planes of shadow of the body, with the X-ray tube in two different positions. Measurements of the distance of the crossing of these planes from one or more points marked upon the skin give the exact situation of the foreign substance.

Accuracy of localization depends upon a knowledge of the position of the tube at the two exposures, its distance from the photographic plate, and upon the proper marking of one or more spots upon the skin by opaque substances that will cast shadows upon the plate. A

special form of apparatus achieves these results in the most satisfactory manner.

The apparatus for locating foreign bodies is similar in principle to that employed so successfully during the past few years in determining the situation of pieces of metal in the eyeball. I have recently designed a new form of localizer, which is shown in the accompanying illustrations. It consists of a firm base, the top of which is covered with sheepskin, and

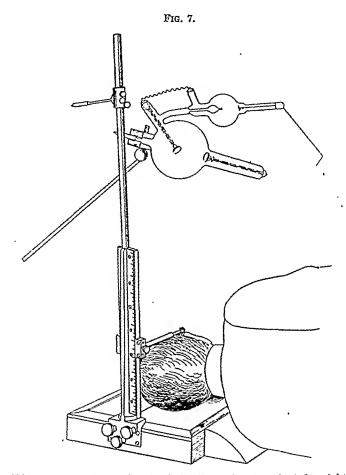


Side view of the indicating apparatus, showing position of tube and indicator, and also receptacle for the photographic plates.

is crossed by two steel wires at right angles to each other. drawer on one side permits the changing of the photographic plate without disturbing the position of the patient. A hollow upright bar attached to one side of the base supports three movable rods. rod has its extremity pointed, over which slips an indicating ball. other rods are employed to indicate the situation of the tube at the two The centre of the indicating ball is directly above the exposures.

crossing of the two wires on the base, and its height is shown by a scale upon the upright bar.

The head or other portion of the body containing the foreign substance to be located rests upon the top of the base portion, the crosswires, previously inked, leaving a mark upon the skin. The indicating rod is lowered until the ball rests upon the skin, and this spot is also indicated with ink. The distance of the ball above the cross-wires is read from the graduated scale.



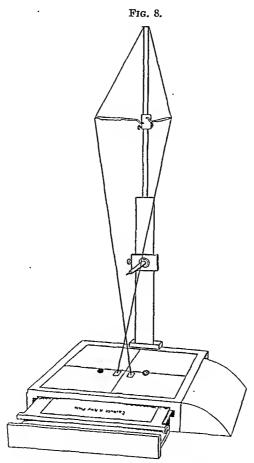
Side view of apparatus, showing indicating rod and graduated upright.

The X-ray tube is placed from eighteen to twenty inches above the plate, and the distance of the anode of the tube carefully measured. One exposure is then made with the tube directly above or to one side of the indicating ball, and a second plate made with the tube from three to four inches from the first position.

After development the plates show the shadows cast by the crosswires, the indicating ball, and the foreign body. The distance of the foreign substance from the marks upon the skin of the patient may be

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determined by plotting upon a flat surface the position of the tube, indicating ball, and the cross-wires at the two exposures, and finding the crossing of the planes of shadow of the foreign body. This method is the one employed in eye-work, and is equally accurate in dealing with other portions of the body, although somewhat more complicated. For this reason I have employed threads to indicate the crossing of the planes of shadow in the new localizing apparatus—a method which has been developed by Mackensie Davidson, of London.



Planes of shadow, represented by threads, the point of crossing of which indicates the situation of the bullet.

The method of employing the indicating apparatus is as follows: A tracing of the two negatives is made upon a transparent sheet of celluloid, with the point of crossing of the wires corresponding. This celluloid sheet is placed upon the top of the base of the apparatus with the tracing of the shadow of the cross-wires directly above the point of crossing of the wires. The indicating rod is moved to the height it occupied at the time the exposures were made. A thread is now passed from the spot on the celluloid representing the shadow

of the indicating ball at one exposure, touches the point of the indicating rod representing the centre of the ball, and is continued the exact distance that the tube was away from the plate when the radiograph was made. A second thread passes in the same manner from the shadow of the indicating ball at the second exposure. The threads are kept taut by lead weights in the hollow upright tube. These two threads accurately indicate the lines of shadow of the indicating ball at the two exposures, and also the position of the tube. If the ends of the threads resting upon the shadows of the indicating ball are now moved to the spots on the transparent celluloid representing the shadows made by the bullet, their crossing will show its position in the tissues in relation to the indicating ball and cross-wires. The distance of this point of crossing from the indicating ball gives the location of the body in the tissues as measured from the spot on the skin at which the ball rested when the two plates were made. The situation of the bullet may also be measured from the cross-wires. The depth of the body will determine which of the two points is to be chosen in plotting the position of the body for operation. The location of each fragment of the bullet is similarly determined.

The apparatus was made for me by Queen & Co., of Philadelphia.

A REPORT OF TWO CASES OF MULTIPLE SARCOMATOSIS OF THE CENTRAL NERVOUS SYSTEM AND OF ONE CASE OF INTRAMEDULLARY PRIMARY SARCOMA OF THE SPINAL CORD.¹

BY WILLIAM G. SPILLER, M.D.,
ASSISTANT CLINICAL PROFESSOR OF NEUROPATHOLOGY IN THE UNIVERSITY OF PENNSYLVANIA;

AND

WILLIAM F. HENDRICKSON, M.D.,
ASSISTANT DEMONSTRATOR OF PATHOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

(From the William Pepper Clinical Laboratory, Phoebe A. Hearst Foundation.)

SARCOMATOSIS of the central nervous system apparently has not received much attention from American physicians, although a few cases have been reported by English writers and quite a number may be found in the German literature. Cases of this character must have occurred in this country, and it is to be hoped that they will be put on record. One such has recently been seen in the service of Dr. F.

¹ Read at the meeting of the American Neurological Association, May 12, 1903.

² Dr. H. T. Patrick has called my attention to a case of diffuse sarcoma of the cerebral and spinal pia mater, reported by George K. Weaver in the Journal of Experimental Medicine, 1898, vol. iii., No. 6.

X. Dercum, although the sarcomatosis in this case was not confined to the nervous system. Two cases of sarcomatosis of the brain and spinal cord, or of their membranes, in one of which the sarcomatosis was certainly confined to the central nervous system, and in the other was probably so confined, have been observed by one of us (Spiller), and are reported here in connection with a case of primary sarcoma of the substance of the spinal cord. The first case was to have been reported by the late Dr. W. F. Hendrickson, and the material had been partially studied by him at the time of his death. His notes are in quotation marks.

The patient¹ was in the service of Dr. Van Gasken, at the Woman's Hospital of Philadelphia, and I am much indebted to her for permission to use the clinical notes and to report the case.

Case I.—L. K., aged twenty-one years, married, was admitted to the Woman's Hospital of Philadelphia, January 4, 1902, when the following notes were made:

The family history was unimportant.

The patient had been strong as a child. She had had scarlatina, diphtheria, and other diseases. She menstruated when fourteen years of age, but her periods were not always regular. They were painless, and lasted from four days to a week. She was well until after she was married, at the age of twenty years. She gave birth to a child five months ago; the labor was normal. She has not had much sore-throat, but last fall her hair came out.

Three days after her child was born she had a severe headache in the occipital region. The pain was shooting, and began at the base of the brain and extended upward; it was very severe but transient. Occasionally she had a sensation of pressure on the head. After the headache passed off she felt giddy and saw everything double, and shortly afterward she was told that she was cross-eyed. She had not had any paralysis of the ocular muscles previously. She had no fever. She had profuse sweating followed by cold, creepy feeling, after which she became very giddy. She had a shooting pain under the sternum. She has been confined to bed thirteen weeks. The toes first began to get stiff, and the stiffness gradually extended upward until now she has no power below the waist. At the first appearance of stiffness of the limbs she suddenly lost power to urinate voluntarily, and since then urination and defecation have been involuntary.

About a week ago a red spot appeared on the hip, and ulceration

has occurred at this place.

The tongue is dry and coated.

Pulse, 108; temperature, 98.4° F.; respiration, 28. Two large bed-sores are found on the left thigh.

January 5th. Patient has complained of pain in the back and over

the epigastrium.

The result of the examination of the eyes by Dr. Mayo, January 6th, is as follows: Pupils react normally to light and in convergence.

¹ A brief reference to this case was made in a paper published in the University of Pennsylvania Medical Bulletin, April, 1903.

Complete paralysis of the external rectus of each eye with paralysis of one of the oblique muscles, but the condition of the patient renders it impossible to determine which one. Ophthalmoscopic examination: Media clear; marked swelling of optic disks with hazy outlines; vessels tortuous; no hemorrhages; macular region normal.

I saw the patient in consultation January 7, and the result of my

examination is as follows:

Pupils are equal and react promptly to light. The inward movement of the left eye in convergence is greater than that of the right. Head is slightly retracted, and neck is somewhat stiff. She has apparently no deafness. A papulopustular eruption is seen on the face and upper parts of the limbs. Tongue is protruded partially; no fibrillary tremor and no atrophy of tongue. No paralysis of facial muscles. Masseter contracts firmly on each side. Headache is general, but more severe in the frontal region; sometimes it is occipital. It is not worse at night. Patient moans continually as if in pain. Sensation to touch, heat, and pain is normal in the face. The head is rotated from at night. side to side slowly and with much pain in the neck.

The grasp of the hands is nearly normal, but the effort to use the hand causes intense pain in the lumbar region. The upper limbs are moved freely in all directions. During the examination the patient yawns frequently. Sensation for touch, heat, and pain in the upper limbs is normal. Biceps tendon, triceps tendon, and wrist reflexes are normal. The muscles of the upper limbs and the ulnar nerves are not tender to pressure. Pressure along the spine is not distinctly painful

except between the shoulders.

The lower limbs are completely paralyzed. The patellar reflex on the right side is present but diminished, and on the left side it is almost lost, and on each side the reflex is very little increased by reinforcement. Slight ankle clonus is obtained on the right side, but not on Achilles tendon jerk is exaggerated on the right side, normal the left. on the left. Babinski's reflex is present on the right side, but soon It is present also on the left side, and the big toe moves distinctly upward. The plantar reflex is decreased on each side. Sensation for touch, pain, and temperature is apparently abolished in the Muscles and nerves of the lower limbs are without sensation from pressure. Any passive or reflex movements of the lower limbs causes intense pain extending from the front of the abdomen to the back. Sensation to pin-pricks, temperature, and touch is first perceived on the trunk at a level with the seventh rib in the sternal The area where anæsthesia passes into normal sensation is not sharply defined. No distinct deformity of the vertebral column is seen.

Cerebro-spinal fluid was obtained by Dr. Everitt in lumbar puncture. It was clear, and without reddish tinge. Fibrin was present in small amount. No cells or bacteria were found. Cultures on agaragar showed a few colonies. Examination after twenty-four hours' growth showed the presence of a micrococcus. This report was given

by Dr. A. W. Peckham.

The patient slept very badly, was restless, and suffered much pain.

She died January 22, 1902.

The necropsy was made by Dr. Hendrickson and the following notes are by him:

"Anatomical Diagnosis. Multiple tumors of the spinal cord, tumor of cerebellum, congestion of cord and brain; slight congestion of lungs, spleen, liver, and kidneys.

"Histological Diagnosis. Small spindle-cell sarcoma of the cerebellum with multiple new-growths of like character of the spinal cord;

congestion of heart, spleen, liver, and kidneys.

- "External Appearance. Body that of a fairly well-developed, but poorly nourished white female. Rigor mortis present in both upper and lower extremities, to a slight degree, although body is still warm. No cedema. Slight post-mortem lividity of dependent portions. On right thigh over head of femur is found a large, deep bed-sore, fully 8 cm. in diameter. There is also a smaller, more superficial one over the left side in corresponding position.
 - "Abdominal cavity normal. "Pleural cavity normal.

"Pericardial cavity normal.

"Heart. Not removed or opened. "Lungs. Incision in situ shows considerable congestion and ædema, but otherwise negative.

Normal except for slight congestion.

"Gastro-intestinal Tract. Not opened.

"Liver. Surface everywhere smooth and glistening. In size the organ is normal. On section there is found to be slight congestion of bloodvessels, but surface markings are everywhere distinct. Consistency normal. There is absolutely nothing indicating a syphilitic lesion. Gall-bladder negative.

"Kidneys of normal size, capsule strips easily, surface markings fairly distinct. There is slight congestion.

"The above examination of organs was done very hurriedly and necessarily somewhat incompletely because of lack of time; the examination of the brain and cord having received the most careful attention.

"Spinal Canal. On removal of vertebral arches from the upper cervical region down to the cauda, the external surface of the dura mater covering the cord is found to show moderate congestion of the bloodvessels. There is also a slight deposition of fibrin over this surface in the dorsal region which is found blood-stained, probably from hemorrhage in removal of the cord.

"After the removal of the cord from the spinal canal and removal of dura mater, the following condition is found: There is no evidence of inflammation of the pia-arachnoid coat, although there is moderate congestion of the bloodvessels. In the dorsal region, however, beginning about 14 cm. (5½ inches) from the lower extremity of the cord and extending upward for a distance of 5 cm. (2 inches), a distinct fusiform swelling of the cord is seen. This swelling at the point of greatest thickness measures 15 mm. (5 inch), as compared with the adjacent cord, which measures 12 mm. (2 inch).

"The consistency of the swelling is firm, being slightly more so than that of the adjacent uninvolved cord. Meninges over this area show nothing remarkable. One centimetre (3 inch) above the upper border of this swelling there is another small nodule not more than 1 cm. (\$ inch) in length. In this case as in the lower swelling the enlargement is symmetrical, but not quite so distinct; the diameter being not more than 14 mm. (½ inch). Section through these enlarged portions

of the cord reveals an apparent new-growth. All the surface markings normally found have been obliterated, and instead is seen a uniformly gray, more or less translucent tissue of rather firm consistency. There is no dilatation of the central canal. There is no evidence of hemor-

rhage in the involved area.

"Brain. There is marked uniform congestion of the bloodvessels of the pia-arachnoid coat. No evidence of inflammatory exudate. No thickening of meninges. No ædema. After removal of brain from skull there is found lying over the superior surface of the left cerebellar lobe a diffuse, irregularly lobulated tumor of fairly firm consistency. It extends practically from the median line separating the right from the left cerebellar lobe, over the superior surface of the left cerebellar lobe to the extreme left border, and from a point corresponding to the anterior border of the pons to within 1 cm. (3 inch) of the posterior border of the cerebellum. The tumor is roughly divided into three large lobes of irregular shape, with smaller lobes subdividing them. The borders are for the most part abrupt and in places give the impression of pedunculation, but elsewhere they seem to become lost gradually into the surrounding pia and brain tissue. There are no congested bloodvessels over the surface. Tumor mass is 2 cm. (3 inch) above the general cerebellar surface. Section into tumor at one point shows the growth to extend fully 3 cm. (11 inches) deep. In color it is gray and corresponds in general appearance to the masses found in the cord. There is no evidence of softening at the point incised. hemorrhage. The inferior surface of the left occipital lobe shows slight flattening of convolutions corresponding to the situation of the underlying cerebellar tumor, and it is probable that the entire inferior surface of the left occipital lobe was subjected to direct pressure. far as can be ascertained without considerable dissection, there is no connection of the cerebellar new-growth with any portion of the brain aside from the cerebellum.

"Cerebellar Growth. Sections from different portions show practically the same condition. The growth is found to consist of small, spindle-shaped cells of the embryonic, connective tissue type. These cells compose the bulk of the tumor; they are closely packed together and are found to follow no order in distribution and arrangement. In places there is a very delicate connective tissue stroma lying between the cells. This stroma when present in sufficient amount tends to form small alveoli in which the tumor cells lie. The bloodvessels are fairly numerous throughout the sections examined, and are seen to have very thin walls. In many places nothing but endothelium exists between the lumen and tumor cells. The underlying brain tissue is found to be infiltrated with tumor cells in varying degree. No evidence of degree existion can be discovered in any part of the tumor.

degeneration can be discovered in any part of the tumor.

"New-growths of the Spinal Cord. They resemble in all respects the new-growth in the cerebellum. Sections from the larger growth referred to in the gross description reveal complete obliteration of the entire cord. The small, spindle-shaped tumor cells form one diffuse mass occupying the entire transverse section of the spinal cord. The pia-arachnoid coat is also involved. It is considerably thickened and shows everywhere in varying degree infiltration with tumor cells. This is especially well marked about the congested bloodvessels.

"In the centre of the growth occupying the cord are discovered

several irregularly shaped areas of small size which take up the eosin stain more markedly. Examination with high power shows few nuclei to be present and those which are do not stain well with hæmatoxylin. There is considerable finely granular detritus which stains light pink and a few compound granular corpuscles. No nerve fibres can be made out. Sections from the smaller of the two nodules referred to in gross description show practically the same condition as seen in the large one, but the process has not advanced so far. Although there has been complete replacement of the spinal cord by the new-growth, the pia-arachnoid coat is not invaded to such a marked degree. Throughout the pia there is considerable ædema, but very slight cellular exudate from the vessels. That which exists is confined entirely to the zone immediately about the vessels, which is also the seat of most marked growth of tumor cells. No areas of degeneration are to be found."

The examination of the sections from this case was not completed by Dr. Hendrickson, but further study has been made by me.



Photograph of a section from the thoracic region of the spinal cord in Case I., showing an intramedullary tumor surrounded by the partially degenerated spinal cord. The connection of the tumor with the pia is shown by the sarcoma cells within the pia of the anterior fissure, extending from the intramedullary tumor to the pia surrounding the cord.

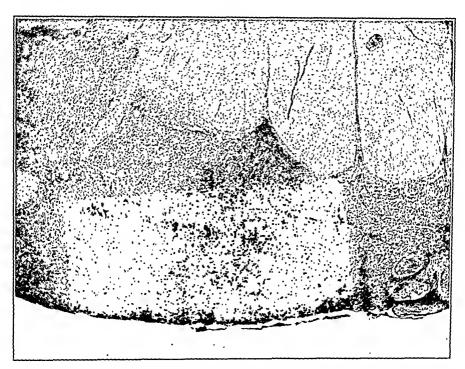
Numerous small tumors are scattered throughout the pia of the spinal cord, especially in the posterior portion. The origin of one of the large intramedullary tumors of the cord can be traced distinctly to the pia. Cells are seen in great numbers extending through the pia of the anterior fissure into the substance of the cord, where they have proliferated to form the tumor, which is surrounded by a narrow band

of partly degenerated cord substance. (Fig. 1.) In the greater part of the spinal cord the tumors of the pia do not infiltrate from the pia into the cord substance, but here and there a beginning infiltration

may be seen. (Fig. 2.)

The pia of the anterior fissure is infiltrated with tumor cells at portions where no tumor is found within the cord. The nerve cells of the anterior horns in the lower cervical and lumbar regions stain well by thionin, and appear to be in a very good state of preservation. The anterior and posterior nerve roots, though surrounded by tumor masses, appear to be in an excellent condition.

Fig. 2.



Photograph of a section from the spinal cord in Case I., showing the infiltration of the pia with sarcoma cells. In most places the sarcomatous tissue is sharply defined by the spinal cord, but at one side of the photograph the invasion of the spinal cord by the tumor cells is shown.

Sections from about the eighth cervical segment, and, therefore, above the intramedullary tumors, stained by the Weigert hæmatoxylin method show that the spinal cord was little degenerated. Scattered through these sections are small, faintly stained areas in which the nerve fibres have disappeared. The absence of pronounced ascending degeneration can be explained by the softness of the intramedullary tumors and the absence of compression and destruction of many axis cylinders passing through the tumor, and by the absence of degeneration in the posterior roots. The bloodvessels of the pia and of the spinal cord are not diseased.

Sections from the lumbar region stain well by the Weigert hæma-

toxylin method, and do not show distinct degeneration.

The Marchi method could not be employed.

Case II.—The patient, a man aged forty-two years, was admitted to the University Hospital, into the service of Dr. C. K. Mills, December, 1902, and later came under my care when Dr. Mills went off duty.

He was married and had five children. He had been a glass-worker and glass-blower all his life. His father had died at the age of sixty years; his mother at the age of sixty-two years, of Bright's disease.

Two sisters are living and well.

He had never had earache or any discharge from the ears. About one year ago he began to complain of failure of eyesight. At that time he was able to work. A short time after his eyesight began to fail he began to have pain in the left occipital region extending to the left temporal region. The pain is now constant but much worse at night, especially late in the night or toward morning. He cannot lie on the left side because the pain in the head is increased by this position.

He sleeps better in a chair than in bed. For about six months he has had difficulty in walking; he becomes dizzy and falls. He has had two attacks of unconsciousness, one during the past summer, and one two weeks ago, lasting several hours. He did not have convulsions in either attack. At times he has attacks of vomiting without any apparent cause. He has a voracious appetite, and eructation of gas occurs after eating. He has also shortness of breath, some failure of memory, and at times homicidal impulses, especially when suffering intense pain.

The report on his aural condition given by Dr. B. A. Randall, December 29, 1902, is as follows: "He has a labyrinthine involvement; on right side apparently total, with marked deafness on the left

side.''

The report of the ocular examination made by Dr. E. A. Shumway, December 30, 1902, is as follows: "Optic neuritis (choked disk), O. D. Optic atrophy, O. S. Paralysis of external rectus in each eye. Convergent strabismus (paralytic). V.—R. E., 6/12 V.; L. E., fingers six inches. Pupils: O. S. larger than O. D., rather dilated. Both pupils respond to light. Diplopia impossible to elicit on account of poor vision in O. S. External rectus paralyzed on each side; eyes will not move beyond median line. Eye-grounds—Right: choked disk; difference of level of 4 D. (1\frac{1}{3} mm.) between nerve head and retina; surrounding retina swollen, opaque; veins tortuous, dipping in and out of swollen retina. Left: atrophy of nerve, veins slightly tortuous, edges of nerve clean cut, no heaping up of connective tissue, arteries reduced in calibre."

An examination made by me December 31, 1902, gave the following results: The man is very deaf, but his intelligence is good and he replies promptly to signs. The facialis is not involved on either side. The sensory and motor portions of the trigeminus are not involved on either side. He contracts both masseters equally and well, and moves the lower jaw freely from side to side. He has no disturbance of sen-

sation on either side of his face, either for pain or touch.

The tongue is protruded in the median line, but has a slight tendency

to deviate to the left.

When the eyeballs are at rest they are in convergent strabismus, the right eye being turned more inward than the left. (Fig. 3.) When he attempts to move his eyeballs from side to side, neither eyeball passes

beyond the median line outward. He has no nystagmus, even in

attempting to look to one side or the other.

He complains of soreness over the left supra-orbital and infra-orbital foramina, but has no tenderness over the left mental foramen, and no tenderness on pressure over the exit points on the face of the right trigeminus. The oculomotor nerve is not affected on either side.

The grasp of the hands is good on each side, and there is no impairment of the voluntary movements of the upper limbs. A slight tremor is noticed in each hand as he touches the first finger to the nose; this seems to be a form of ataxia. Biceps tendon, triceps tendon, and wrist reflexes are prompt on each side, and very little if at all exaggerated. The voluntary power in the lower limbs is normal. Gait is slightly ataxic with the eyes open, and the ataxia is a little increased when the



Photograph of the man described in Case II., showing paralysis of each external rectus, greater on the right side.

eyes are closed. The erect station is good with the eyes open or closed. The patellar reflex is a little exaggerated on each side. He has a slight tendency to ankle clonus on the right side, but not on the left. The Babinski reflex is not present on either side. The Achilles tendon reflex is a little prompter than normal on each side. Hemiasynergy cannot be obtained.

An examination made by Dr. Mills and myself January 1, 1903, gave the following results: The man says he can hear a bell when it is struck, he hears it in the left ear but not in the right, and he hears the voice but does not understand words, and has not been able to hear words during the past two weeks.

Sugar was not tasted at first on the left side of the tongue after thorough rubbing, but was tasted when it was rubbed over the entire tongue. Salt was tasted promptly on the left side of the tongue.

sense of smell was preserved.

Percussion of the head just behind the left ear causes pain, but there is no tenderness on percussion of the left side. The man says that he has no pain in the right side of his head, but on the left side the pain begins in the back of the head and extends to the frontal region. chief area of tenderness is just behind the left mastoid, and he flinches when pressure is made at this spot. He has less tenderness over the mastoid process.

The diagnosis of cerebellar tumor, probably on the left side, was

My examination on March 4, 1903, gave the following results: In walking he staggers slightly and his tendency is to go toward the left. Vertigo comes in attacks, and at these times he has great difficulty in walking because of his staggering gait. He has been seen in these attacks by the head nurse. The attacks of vertigo are of short duration, not over a few minutes. He was seen in an attack also by the resident physician, Dr. Hunter. The patient was sitting on the edge of the bed; his head fell forward on his chest, the trunk bent forward, the upper limbs shook, and the body lunged toward the left and slightly forward; this was followed by partial recovery and then another lunge. The attack lasted about one minute and a half.

The man's condition has not changed much since last December. The patellar reflex on each side is prompt and not much exaggerated. Ankle clonus and Babinski's reflex are not obtained, the movement of the toes being flexion from irritation of the sole of the foot. Achilles jerk is prompter than normal on each side. The resistance to passive movements in the upper and lower limbs is normal on each The grasp of the hands is good. Tendon reflexes of the upper limbs (triceps tendon, biceps tendon, and wrist reflexes) are about normal. There is no involvement of the sensory or motor portions of the trigeminus or of the facialis on either side. Pain is promptly perceived in the face on each side. The corner of the mouth is well drawn up and the forehead well wrinkled on each side. is protruded straight. Nystagmus is not distinct, but when the patient moves his left eyeball far to the right a little inco-ordination is observed in this eyeball. Nystagmus probably is prevented by the paralysis of each external rectus.

The operation for removal of a cerebellar tumor was done by Dr. C. H. Frazier, March 6, 1903. The man was restless, delirious, and violent after the operation, and he never regained consciousness fully.

pulse rate was high, 140 at times. He died March 9, 1903.

The necropsy was made by Dr. Richard M. Pearce, who very kindly placed the material in my hands. Permission was obtained only for the removal of the brain and spinal cord.

A deep incision, extending about half-way into the left cerebellar hemisphere, with softened brain tissue about it, is the result of the

operation.

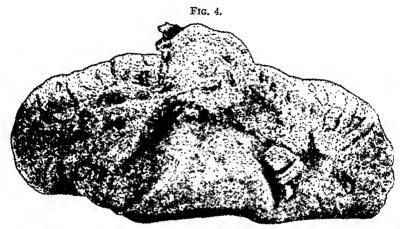
A tumor 2 cm. (3 inch) in anteroposterior diameter and 2.5 cm. (1 inch) in lateral diameter was found in the angle made by the pons at its junction with the left cerebellar hemisphere. (Fig. 4.) The facialis and acusticus on this side were compressed by the tumor, and a smaller tumor was found enveloping these nerves and lying posterior to the larger tumor. A tumor about 1 cm. (3 inch) in each diameter was found in the angle made by the union of the pons with the right lobe of the cerebellum, but it did not implicate the right facialis and acusticus. The left trigeminus at its entrance into the pons was envel-

oped in a small tumor mass.

The medulla oblongata was much enlarged, and the posterior portion of it fluctuated as though a cyst were contained within it, but this fluctuation was caused by a soft tumor filling the posterior half of the fourth ventricle and infiltrating slightly the dorsal part of the medulla oblongata. Although the circulation of cerebrospinal fluid within the fourth ventricle must have been disturbed by this growth, the fourth ventricle was not enlarged.

The right facialis and acusticus were embedded in a small, soft tumor at their entrance into the internal auditory meatus, and the right glossopharyngeus, vagus, and accessorius were embedded in a similar mass at

their entrance into the jugular foramen.



Photograph of the cerebellum, pons, and medulla oblongata from Case II. A tumor is shown in the left cerebello-pontile angle, and the medulla oblongata is very much enlarged on account of a tumor on the floor of the fourth ventricle.

The pituitary body, optic chiasm, and each Gasserian ganglion were embedded in soft tumor masses. Each Gasserian ganglion was about twice the usual size on account of tumor formation about and within it.

A small papillomatous mass was found protruding from the dura over the front part of the second left frontal convolution, and when the dura was removed this mass was found to be adherent to the pia and to have penetrated the dura.

The left offactory bulb was embedded in a small tumor.

Small tumors, some the size of a pin's head and some larger, were found scattered throughout the spinal pia and enclosing many of the spinal roots, especially in the cauda equina. (Fig. 5.) They were more numerous on the posterior aspect of the spinal cord. Some of these tumors in the cauda equina had a papillomatous appearance.

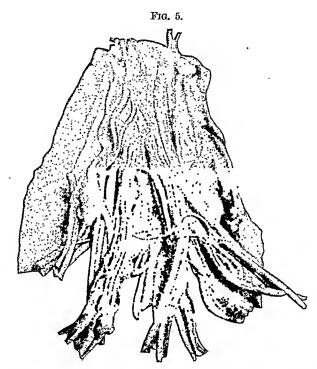
Several of the cranial nerves implicated by the tumors were cut in

microscopic sections and examined.

Transverse sections of the left opticus showed that the sheath of the nerve was infiltrated by tumor cells, but nowhere within the nerve

were distinct tumor masses found, although there were many cells resembling those of the tumors scattered between the nerve fibres. Weigert hæmatoxylin sections of the nerve showed that much degeneration of nerve fibres had occurred.

Sections of the left Gasserian ganglion showed that the tumor had infiltrated between the nerve bundles and nerve cells of the ganglion. Some of the nerve cells were partially degenerated, having a shrivelled appearance, and the nuclei were eccentric. Some of the nerve cells stained very faintly and contained few chromophilic elements.



Photograph of the conus medullaris and cauda equina from Case II. Numerous small tumors are found growing about the nerve roots.

Sections of the right Gasserian ganglion stained by the Marchi method showed that the nerve fibres of the ganglion were in a moderate degree of recent degeneration.

The right abducens contained numerous areas free of nerve fibres, and yet by the Weigert hæmatoxylin stain the nerve appeared to be in a fair state of preservation. Degeneration was not found within the

nerve by the Marchi method.

The left facialis was partly degenerated, as shown by the Weigert hæmatoxylin stain, and very intensely degenerated, as shown by the Marchi method. It is, therefore, remarkable that facial paresis did not exist.

The left acusticus was also much degenerated, as shown by the

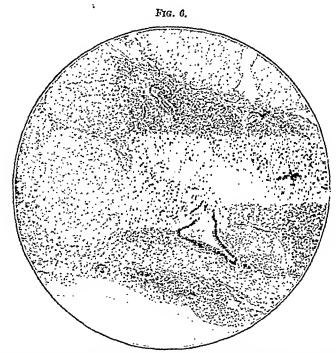
Weigert hæmatoxylin stain.

The right accessorius appeared to be normal by the acid-fuchsin and Weigert hæmatoxylin stains, but was shown to be distinctly degenerated by the Marchi method.

The tumor on the floor of the fourth ventricle infiltrated the dorsal part of the medulla oblongata, but did not invade the nuclei of the

hypoglossal nerves.

Although numerous small tumors were present in the pia of the spinal cord, at no place were they found infiltrating the cord. They surrounded many of the nerve roots, and yet caused very little degeneration of these roots. Secondary degeneration, either ascending or descending, was not found in the spinal cord by the Weigert hæmatoxylin or acid-fuchsin stains, but very slight degeneration of the posterior columns, both in the cervical and lumbar regions, was detected by the Marchi method. Posterior root fibres could be seen passing through the small tumors of the pia, and yet staining well by the



Photograph of a section from the spinal cord in Case II., showing the infiltration of the pia with tumor cells. These cells have not invaded the spinal cord, and the nerve roots surrounded by the tumor mass appear normal. The columnar cells are seen in places.

Weigert hæmatoxylin or acid-fuchsin methods. A spinal nerve root embedded in a small tumor was found to be normal with the exception of a few slightly swollen axis cylinders. The bloodvessels of the pia and of the spinal cord were normal.

Many of the nerve cells in the anterior horns of the lumbar region stained by the thionin were much vacuolated, otherwise they were

normal.

The resistance of the nervous tissue proper to tumor infiltration throughout the brain and cord is remarkable, and little degeneration has been caused by the numerous tumors, because they were soft and produced little pressure.

The tumors everywhere have much the same structure. They consist of round or somewhat elongated cells, and even by Mallory's

neuroglia stain contain very little intercellular tissue. In some places the cells are distinctly columnar and resemble those of the ependyma. (Fig. 6.) The columnar cells are arranged in long rows and have a large nucleus situated at one end of the cell. These rows of cells are found especially about the bloodvessels, but also where there are no bloodvessels. There is unquestionably a close resemblance between these cells and those of the ependyma, and the temptation, therefore, is to call the tumor an ependymoma, but it seems remarkable that an ependymoma, being a form of glioma, should give extensive metastasis to the pia of the spinal cord, which is of mesodermic origin. · This, and the absence of glia fibres between the cells, and the distinct tendency to the formation of rows of cells about the bloodyessels, seem to justify the classification of the tumors under the sarcomata, possibly endotheliomata or peritheliomata, and yet the close resemblance of some of the cells to those of the ependyma may permit us to regard the growth as a mixed one, and as being partly a sarcoma and partly an ependymoma. The ependyma is known to proliferate in cases of syringomyelia when the cavity extends to the central canal, and to cover in part the wall of the cavity. It is not unreasonable to suppose that a sarcoma growing from the pia may extend to the fourth ventricle, and by irritation of the ependyma lead to its proliferation, and cause in this way a mixed tumor. This view is supported by another case in which a very similar tumor was found growing over the pons and implicating the posterior part of the fourth ventricle. A smaller tumor, probably metastatic, was found in the pia of the spinal cord, and the rows of ependyma-like cells were not so evident in this, although they were very striking in the large tumor. The tumors in Case II. have a resemblance to those described by Rosenthal,1 Fracnkel, and Benda² as neuro-epitheliomota, and yet in some respects they are very different.

CASE III.—J. C., aged thirty-nine years, a laborer, Italian, was admitted to the Philadelphia Hospital, in my service, June 28, 1902. He had paralysis of both lower limbs. His history so far as it could

be obtained was as follows:

About three weeks before admission to the hospital he had had pain in the lower thoracic region and sensation of pressure about the waist, probably a girdle sensation. The pain had persisted in the abdomen and back. The left lower limb became weak, and soon the right lower

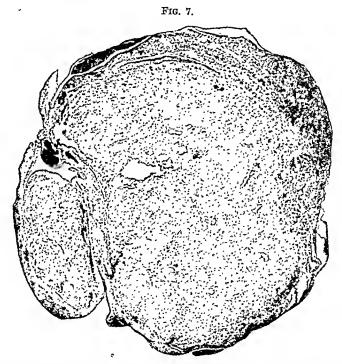
limb was affected.

Notes made July 20th recorded that for three weeks he had had incontinence of urine and feces. He had not had pain in the lower limbs. The lower limbs were almost completely paralyzed. He was able on great effort to make slight movement of the right lower limb, chiefly with the thigh muscles. The limbs, except the soles of the feet, were not atrophied. The feet were ædematous and pitted slightly on pressure. The legs and thighs were not ædematous. The lower limbs were not contractured and were flaccid, especially the right. The patellar reflex was present on each side, but was diminished; the leg and foot on each side were very slightly moved voluntarily, but contractions were seen in the quadriceps muscles. The patellar reflex on the left side was a little prompter than on the right. Ankle clonus

¹ Ziegler's Beiträge, xxiii. ² Deutsche med. Wochenschrift, 1898, xxiv. p. 457.

and Achilles reflex were not obtained on either side, and the loss of these reflexes was not caused by rigidity of the muscles. Talipes equinovarus was present on each side, although the varus position was not pronounced. Babinski's reflex was not obtained on either side. and the toes did not move distinctly in either direction. The soles of the feet were scaly. Sensation for touch and pain was lost in the lower limbs and over the lower part of the trunk, both back and front, to a line passing about two inches below the nipples. A bed-sore was over the left buttock. The upper limbs and head were not affected. The right pupil, however, was much larger than the left. The spinal column was not deformed.

A diagnosis was made of transverse lesion of the upper part of the thoracic cord, causing complete or nearly complete destruction of the cord at this part.



Photograph of a section from the thoracic region of the spinal cord in Case III., showing the intramedullary sarcoma partially surrounded by the degenerated spinal cord.

On August 9th the man's condition was as follows: He had still incontinence of urine and feces, and had had this since his admission to the hospital. He was in semi-stupor. The face appeared ema-The upper limbs were well developed, but not muscular. The only voluntary movements possible in the lower limbs were in the flexor muscles of the thighs. Babinski's reflex was distinct on each side at this examination, but ankle clonus, Achilles tendon reflex, and patellar reflex were not obtained on either side. The plantar muscles of the feet were much wasted. The man died September 9, 1902.

After the spinal dura was opened an elongated swelling was found

in the spinal cord just above the midthoracic region. This enlarge-

ment was about one inch in length. When a transverse cut was made through the middle of the swelling a tumor embedded within the substance of the spinal cord was found. No tumor could be detected elsewhere in the spinal cord, brain, or their membranes. Only the brain and cord were examined. The material was hardened in Orth's fluid.

A transverse microscopic section through the middle of the tumor shows that it is composed of spindle cells; it is, therefore, a large spindle-cell sarcoma, the cells being considerably larger than those within the tumor of the first case reported in this paper. The tumor fills the centre of the spinal cord and has a narrow band of cord substance about it, although on one side it extends to and invades the pia. (Fig. 7.) The cord substance at the periphery of the tumor is very much degenerated and stains poorly with the Weigert hæmatoxylin. The bloodvessels everywhere in the section are much congested. Round-cell infiltration is present about some of the bloodvessels of the pia, and infiltration of tumor cells is found in some of the nerve roots. Some of the nerve roots are degenerated.

Sections taken just below the tumor show the changes commonly seen in compression myelitis, viz., loss of nerve fibres, proliferation of neuroglia, some swelling of axis cylinders, and small, recent hemorrhages. The spindle cells of the tumor are not present at this level, either within the cord or pia. Sections stain well by the Weigert hæmatoxylin method, but contain numerous areas of necrosis. It is impossible to trace anywhere an origin of the tumor from the pia.

The nerve cells of the anterior horns in the lumbar region appear to be normal. Much degeneration is revealed by the Marchi method in the direct and crossed pyramidal tracts of the lumbar region. Flechsig's oval field in the posterior columns is partly degenerated. Sections stained by the Weigert hæmatoxylin method are a little pale; otherwise the property of the section of the

wise they appear to be normal.

Sections taken above and near the tumor stain well by the Weigert hæmatoxylin method, but the posterior columns, especially those of Goll, are partially degenerated. The anterior and lateral columns appear by this stain to be normal. Sections taken a little lower and at the upper border of the tumor reveal great degeneration, numerous necrotic areas, and much recent hemorrhage. Except at the level of

the tumor sarcoma cells are not found in the pia.

Sections from the eighth cervical segment stained by the Weigert hematoxylin appear to be normal, except that the columns of Goll are much degenerated. By the Marchi method great degeneration is seen in the columns of Goll at this level, slight degeneration in the columns of Burdach, and very considerable degeneration in the direct cerebellar and Gowers' tracts and along the periphery of the antero-lateral columns. The nerve cells of the anterior horns at this level are deeply pigmented, but otherwise they appear to be very little altered.

A brief summary of the cases is as follows:

Case I.—The patient, a woman, had been well until one year after marriage. Three days after the birth of her child she had severe headache in the occipital region. After the headache ceased she was dizzy and had diplopia from external ocular muscle palsy. The lower limbs

gradually became stiff and weak, until finally they became completely paralyzed, and control over bladder and rectum was lost. Examination of the eyes showed paralysis of both external recti muscles, with paralysis of one of the oblique muscles, but the patient's condition made it impossible to determine which one. There was marked swelling of the optic disks, with hazy outlines, and the vessels were tortuous. Five months after the birth of her child her head was slightly retracted and the neck was a little stiff, and she moved the head from side to side with difficulty. The headache was still severe. The upper limbs were moved voluntarily and freely, and sensation in the upper limbs was normal. The lower limbs were completely paralyzed, and the patellar reflex-was much diminished on each side. A slight ankle clonus was present on the right side, and Babinski's reflex was present on each side. All forms of sensation were lost in the lower limbs.

Two intramedullary sarcomata were found in the thoracic region of the spinal cord, and there were numerous small sarcomata in the spinal pia; a large sarcoma also was found in the left cerebellar lobe.

Case II.—The patient was a man, aged forty-two years. About a year before admission he began to have failure of eyesight and constant pain in the left occipital region. Six months later he began to have difficulty in walking and would get dizzy and fall. He had two attacks of unconsciousness, but without convulsions. He had also attacks of vomiting Dr. B. A. Randall found labyrinthine involvement, apparently total on the right side, and on the left side the deafness was intense. Dr. E. A. Shumway reported that the man had choked disk in the right eye and optic atrophy in the left. Both external recti muscles were paralyzed. The man had a little tenderness over the left supra-orbital and infra-orbital foramina. He had occasionally attacks of vertigo.

An attempt was made by Dr. C. H. Frazier to remove a cerebellar tumor which was believed to be present, and probably on the left side, but was unsuccessful. The operation in this case will be described by Dr. Frazier. A tumor was found in each cerebello-pontile angle, but the larger one was on the left side. Tumors were found about the Gasserian ganglia, pituitary body, floor of the fourth ventricle, right internal auditory meatus, and right jugular foramen, and numerous small tumors were found in the pia of the spinal cord.

Case III.—The patient was a man who had had pain in the lower thoracic region and girdle sensation about three weeks before admission to the hospital. The pain persisted. The left lower limb became weak, and this was followed by weakness of the right lower limb. He had incontinence of urine and feces. He did not have pain in the lower limbs, but the lower limbs became almost completely paralyzed and flaccid, and sensation was lost in these parts and in the trunk

as high as a line passing about two inches below the nipples. The tendon reflexes of the lower limbs were absent, but Babinski's reflex was obtained on each side. A primary sarcoma was found within the spinal cord just above the midthoracic region.

Sarcomatosis of brain and cord and of the pia covering them may cause great difficulty in diagnosis, and in some cases a correct diagnosis may be impossible, as in the second of the cases here reported. Extensive alteration may cause few symptoms, and this has been remarked upon by a number of authors. Schlesinger speaks of it in his monograph on spinal tumors, and it was true of Hippel's' case, in which the sarcoma cells pushed apart the elements of the nervous tissue. In A. Westphal's³ case, also, the extensive sarcomatosis was remarkable in that it caused comparatively few symptoms. The importance of this knowledge, when a question of operation is under consideration, is great, because, if evidence of sarcomatosis is found, the case is an inoperable one. The soft tumor masses grow in the pia about the spinal cord and about the nerve roots, especially those of the cauda equina, and about the cranial nerves, and cause few clinical signs of their presence, because they produce little or no compression or destruction of nervous tissue. In a case like Case II. of this paper, the pia of the spinal cord and brain and the dura at the base of the brain may be extensively infiltrated with sarcoma cells, the Gasserian ganglia and cranial nerves may be embedded in tumor masses, and yet few signs of disturbed function be manifest.

Westphal especially emphasized that sarcomatosis of the membranes has little tendency to invade the spinal cord, whereas in tuberculosis and syphilis the invasion of the nervous tissues is common. He also mentions that in all the recorded cases the posterior part of the pia was the part most affected. This part was also most affected in Case I. and Case II. Sarcomatosis of the membranes of the cord and brain is, according to him, a rapidly fatal disease.

C. Busch⁴ remarks that his case of sarcomatosis of the pia, as well as the cases of Schataloff and Nikiforoff afford proof that sarcoma of the pia has very little tendency to invade the spinal cord and extramedullary roots, even when it surrounds these structures. Case II. of this paper is further evidence of the correctness of this opinion, but Nonne⁵ says that sarcomatosis may invade the nervous tissues, and he gives as examples the cases of Lilienfeld and Benda. He quotes Bruns as saying that the process has very little tendency to implicate

¹ Beiträge zur Klinik der Rückenmarks- und Wirbeltumoren.

² Deutsche Zeitschrift f. Nervenheilkunde, vol. ii. p. 388.

³ Archiv f. Psychiatrie, 1894, vol. xxvi. p. 770.

⁴ Deutsche Zeitschrift f. Nervenheilkunde, vol. ix. p. 114.

⁵ Ibid., vol. xxi., Nos. 5 and 6, p. 369; Archiv f. Psychiatric, vol. xxxiii. p. 393.

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the nervous tissues, whereas Schlesinger remarks that a direct invasion of the spinal cord by the sarcoma cells is frequent. The resistance of the extraspinal roots to the process has been observed by A. Westphal, Schlesinger, Nonne, Benda, and others.

Case I. of this paper shows that occasionally sarcomatosis may extend into the substance of the spinal cord and brain, and both Case I. and Case II. afford evidence of the resistance of the nerve roots to infiltration by tumor cells.

It is partly because of this escape of the nervous tissue in many cases that a correct diagnosis of the extent of the process may be impossible.

The infiltration of the pia resembles that caused by syphilis or tuberculosis, for the process is, if we care to so call it, largely a sarcomatous meningitis. An incorrect diagnosis of syphilis is not unlikely. called attention to the resemblance of a case of his to one of acute cerebro-spinal syphilis, but no history of syphilis and no clinical signs of this disease could be discovered, mercury and iodide were without effect, and such severity of symptoms and rapidity of development he thought were very uncommon in syphilis. To the naked eye the brain and spinal cord in Nonne's case appeared to be normal, and yet the pia everywhere was infiltrated with cells which were believed to have had their origin from the endothelium lining the lymph spaces about the vessels-i. e., the so-called perithelium. The infiltration was especially marked about the optic chiasm and over the pons, and was greater over the posterior portion of the cord than over the anterior. This method of selection is like that occurring in syphilis. The cells invaded the nervous tissue at different places, and this invasion was especially by means of the pial septa. In the cervical region infiltration into the cord was by way of the anterior fissure, as in the case of Mrs. K. (Case I.). A difference from syphilis was found in the absence of circumscribed tumors, so common in syphilis; in the absence of disease of the vessels, and in the uniformity of the infiltration of the pia. The latter without the formation of small tumors here and there was very remarkable, and it seems to be the only case of the kind. The symptoms at first indicated hysteria and later a diffuse process of brain and cord.

The possibility of syphilis in the case of Mrs. K. (Case I.) and also in Case II. was carefully considered. The symptoms in Case I. were strongly suggestive of syphilis, and they had developed a year after the patient's marriage; it was therefore possible that she had contracted syphilis from her husband. The process was evidently a diffuse one involving the brain and spinal cord. Syphilis could cause just such a symptom-complex, but the cerebral symptoms and complete paralysis of the lower limbs without impairment of function in the upper limbs was unlike a syphilitic symptom-complex. It is true that the thoracic

region is often the most diseased part when syphilis attacks the spinal cord, but it is not common even in such cases to find an entire absence of symptoms indicative of implication of the cervical region of the cord. If weakness does not develop, at least pain in the upper limbs is common when the syphilitic process invades the brain and spinal cord. This apparent escape of an intervening part of the central nervous system is suggestive of sarcomatosis, because the sarcoma cells may invade the spinal cord only at one place and cause disturbance of function in the portion of the body innervated from the cord below the diseased area, while the soft tumor masses of the pia above produce no symptoms.

In Case II. syphilis was regarded as possible and antisyphilitic treatment was employed without very brilliant results. The bilateral deafness, the paralysis of each external rectus, the choked disks, the headache and attacks of vertigo could be easily explained by syphilis, and yet the case was one in which tumor cells infiltrated between and about many nerve fibres, and even between the nerve cells of the Gasserian ganglia, and caused very few symptoms.

In F. Schlagenhaufer's' case both trigeminal nerves and the optic chiasm were embedded in tumor masses, but microscopically the tumor cells were found to implicate the pia alone about these nerves. A small-cell sarcoma in the cervical region was believed to be the primary growth, but sarcoma cells were found in the pia of the brain and of the spinal cord. Schlagenhaufer thought that the sarcoma of the cervical region had its starting point within the cord, and was not the result of extension of a growth into the cord from the pia. He believed that to Schlesinger's classification he could add another division, viz., primary sarcoma of the spinal cord with secondary sarcomatous infiltration of the pia.

Schlagenhaufer's case resembles Case I. of this paper in the involvement of the cord by a tumor, and yet the origin of one of the tumors in Case I. could be traced from the pia surrounding the cord through the pia of the anterior fissure. Schlagenhaufer's case resembles Case II. in the implication of cranial nerves by the tumor masses.

Inasmuch as the symptoms in Case I. began three days after the birth of a child, it seemed possible that septic infection had occurred, and that the patient was suffering from purulent meningitis. The duration of the symptoms for five months without any signs of disease of the cervical cord was rather against the diagnosis of purulent meningitis.

That sarcomatosis may give the signs of tuberculous meningitis is shown by a case in a child, aged four years, reported by Lereboullet.²

¹ Obersteiner's Arbeiten, vol. vii. p. 208.

² Abstract in Revue Neurologique, January 30, 1902, No. 2, p. 98.

In Cases I. and II. reported in this paper both abducent nerves were paralyzed, and yet in neither case was there any direct implication of these nerves or their nuclei by the tumor masses; paralysis of both external recti, therefore, does not prove that a tumor is situated on or in the pons.

Tenderness of the vertebral column was one of the first and most striking signs in A. Westphal's case, and it has been observed in other cases, and is suggestive of meningitis, but it is not always present in sarcomatosis of the spinal pia. It was not present in Case II., but was present over a portion of the spinal column in Case I.

Syphilis has sometimes caused the clinical picture of disseminated sclerosis, and therefore it is not surprising that sarcomatosis should simulate the same disease, as in a case reported by Hippel.² The symptoms in this case were optic neuritis passing into atrophy, nystagmus, headache, vertigo, scanning speech, progressive dementia, vomiting, intention tremor, exaggerated tendon reflexes, ataxic gait, and pain in the extremities. The findings were: sarcoma of the right half of the cerebellum; multiple sarcomata of the cerebral and spinal dura, of the pia, choroid plexus, brain, and spinal cord; diffuse sclerosis of the central nervous system, and metastatic sarcomata of the skin.

In this case, as in Case II., a tumor was found at the internal auditory meatus, and in two cases reported by Soyka (cited by Hippel), which were probably cases of sarcomatosis, a tumor was found in each at the internal auditory meatus; so that this, like the pontile cerebellar angle, seems to be a favorite location for sarcoma.

In Case II. the age was more advanced than that at which sarcomatosis is most common. A. Westphal says that most persons with sarcomatosis of the central nervous system have been very young, and that two-thirds of the cases have occurred in childhood. In Case I. the age was twenty-one years.

Schlesinger, in his excellent monograph on spinal tumors, divides primary sarcoma of the nervous system into: 1. Solitary sarcoma.

2. Multiple sarcomatosis.

Tumors of the first group may occur: 1. In the substance of the spinal cord. 2. Primarily in the meninges or nerve roots and (a) remain limited to these parts, or (b) invade the spinal cord.

Multiple sarcomatosis may occur as: (a) Disease of the nervous substance and meninges. (b) Multiple sarcomatosis of the membranes without sarcoma of the cord or brain, when it is (1) in the form of multiple small tumors, or (2) as diffuse sarcomatous infiltration of the membranes.

Schlesinger succeeded in finding in the literature (1898) 18 cases of primary sarcomatosis of the central nervous system with implication of the cord or its membranes, and to these he adds 2, making 20 cases in In 14 of these cases implication of the brain and cord, or of their membranes, occurred. In 9 of these 14 cases cerebellar tumor was found, and in 3 the medulla oblongata was affected. It appears, therefore, that when the brain or its membranes are implicated in sarcomatosis, usually the structures of the posterior cranial fossæ are affected, and that in about two-thirds of the cases a tumor of the cerebellum is found. The diffuse infiltration of the spinal membranes seems to be more extensive in the lower portion of the vertebral canal.

In a case of Bruns and in one of the Vienna Pathological Institute the sarcomatous process extended entirely across the cord. In other cases of sarcomatosis of the nervous system an isolated tumor has been found within the cord, separated by cord tissue from the sarcoma cells of the pia.

Disease of the walls of the bloodvessels, according to Schlesinger, has been observed in only a few cases of sarcomatosis. The vessels were normal in both Case I. and Case II.

Since the publication of Schlesinger's monograph a few more cases of sarcomatosis of the central nervous system have been reported.

The occurrence of a cerebellar tumor in so many of these cases is remarkable, and recently Henneberg and Koch' have mentioned that the angle made by the pons and the lobe of the cerebellum on either side is a common seat for tumors of the posterior fosse. The symptoms seem to indicate that these tumors arise most frequently in the acusticus, but it is possible that the acusticus is the cranial nerve first compressed. These authors point out that the tumor is more frequently on the left side, in the proportion of 3 to 2. It was on the left side in both Case I. and Case II. They say that often neurofibromata cause no disturbance of function in the affected nerves; so that this absence of symptoms is as true of fibromata as of sarcomata.

One of the most recent papers on the so-called tumors of the acoustic nerve is by Fritz Hartmann.2 He calls the location in which they commonly occur the recessus acusticocerebellaris, and he, as others have done, emphasizes that these tumors are loosely attached to the brain, and that their attachment may be easily ruptured. The tumors are usually in organic relation with the acusticus, more rarely with the facialis, and in some cases the acusticus entirely disappears within the tumor; consequently, deafness of central origin is one of the earliest symptoms, as it was in my Case II.

On account of the frequency of tumors in the cerebello-pontile angle,

Archiv f. Psychiatrie, vol. xxxvi., No. 1, p. 251.
 Zeitschrift f. Heilkunde (interne Medicin), 1902, vol. xxiii. p. 391.

such as occurred in Case II., the important paper relative to operation on the posterior cranial fossa recently published by F. Krause may be referred to here.

He has shown by a successfully operated case that it is possible to divide the acusticus intracranially for the relief of severe tinnitus aurium. He entered the skull through the posterior fossa and divided the acusticus. The tinnitus was lessened, but the patient died from pneumonia five days after the operation.

In another case Krause¹ exposed at different operations both cerebellar hemispheres, and although a cerebellar tumor was not found, but internal hydrocephalus was, the condition of the patient was improved, and death did not occur until three years after the operation. The case showed that a cerebellar hemisphere might be incised to a depth of 2 or 3 cm. (²/₄ to 1½ inches) without causing serious symptoms.

Krause has also exposed both cerebellar hemispheres by one flap. The patient died six days after the operation, and was found to have internal hydrocephalus and deformity of the base of the skull. Although such an opening permitted a view of a large part of the cerebellum, it does not follow necessarily that it would have made possible the removal of a tumor situated in the cerebello-pontile angle without causing the death of the patient. A tumor so situated in a case of M. Allen Starr was removed, but the patient died a few days after the operation.

The primary sarcoma within the substance of the spinal cord in Case III. is a very uncommon form of tumor. It is primary, at least so far as the central nervous system is concerned.

Schlesinger² says that primary sarcoma of the cord without implication of the meninges, especially exclusive of the gliosarcoma and the myxogliosarcoma, is of very rare occurrence. He has been able to find only 13 cases. The tumor is usually sharply defined from the surrounding cord tissue, and sometimes encapsulated, which he thinks is important surgically, and yet I do not believe that an encapsulated tumor of the spinal cord can be removed with much benefit to the patient. In 8 cases the primary sarcoma was in the cervical region, in 1 in the midthoracic region, in 1 in the lower thoracic region, in 1 it extended throughout the entire thoracic and lumbar regions, in 1 it was in the lumbar region, and in 2 it extended throughout the length of the spinal cord. In 2 of the 13 cases cavities in the cord were found. In my case the sarcoma was in the thoracic region.

¹ Beiträge zur klin. Chirurgie, vol. xxxvii., No. 3, p. 728.

² Loc. cit.

HISTOLOGICAL CHARACTER AND DIAGNOSIS OF MALIGNANT NEOPLASMS OF THE DIGESTIVE ORGANS AND PERITONEUM.

By John C. Hemmeter, Ph.D., M.D.,
PROFESSOR IN THE MEDICAL DEPARTMENT, UNIVERSITY OF MARYLAND, AND DIRECTOR
OF THE CLINICAL LABORATORY.

THE progressive enlargement, not restricted by any obstacle, and the destructive or corroding advancement of malignant growths have given rise to the impression that cancer cells possess peculiarities of growth not found in other neoplasms. It has been suggested by Hansemann and others that the cells, through the proliferation of which malignant tumors arise, had undergone a change in their biological character. Many efforts have been made to obtain a clear conception of this change of quality, but they have not been successful. Hansemann speaks of an antecedent change in the biological character of the cells, which is claimed to be necessary for pathogenesis of malignant neoplasms, but he does not define this change. In other words, an unknown, indistinct hypothetic factor is introduced, with the hope of clearing up our understanding of the origin of malignant neoplasms. It is evident that nothing is gained by attributing the pathogenesis of such growths to a change in the cells when this change itself remains incomprehensible and undefined. Ribbert1 believes that the physiological processes of growth are sufficient to serve as guiding lines in the development of neoplasms. Hansemann has attempted to make the stronger ability to grow comprehensible by assuming that the cells lose their characteristic peculiarities, a loss of their cellular individuality, whereby they are assumed to revert to a less differentiated stage, approaching again a condition more like the cells of the ovum. reversion or change of cells he calls "anaplasia"—(to build backward) undifferentiation. Hansemann based his conception upon deviations of tumor cells from the character of the normal cells from which they Frequently the neoplastic cells show a simpler morphological quality and structure, which he interprets as a lesser degree of differentiation. For example, pavement epithelium loses its tendency to become hard or horny-like epidermis, and in cancers may represent morphologically indifferent cell forms. But this simplification of the structure of tumor cells is frequently not found in cancers. For example, the pavement epithelium of the epidermic cancer may show extensive cornification in the lymph glands and secondary metastases, and is indistinguishable from the epithelium of the primary seat

of origin. The cylindrical cell carcinoma may form mucus in the secondary nodules. The osteosarcoma produces calcified bone substance in the metastases found in internal organs.

The anaplasia of Hansemann becomes less and less evident the nearer the neoplasm is traced to its beginning stages, that is, in those stages where it would count most as an etiological factor it is less evident. In order to be considered a cause it should precede the development of a neoplasm, not follow it. Ribbert considers the anaplastic changes as secondary, as a reversion. Hansemann holds that new cells, peculiar to themselves, arise by this process. This is denied by Ribbert, who interprets it as a reversion to a previous stage in development.

Hansemann' first used the word "anaplasia" in 1890, the prefix being ava (from ava, backward, and πλάσσειν, to build, building, "zurück." "backward"). He understands by it a condition in which the cells have lost, in part, their specificity, have become "entdifferenzirt," so that they have acquired the property of independent existence, have lost what he calls "altruismus." He conceives that this anaplasia is brought about by abnormal, especially unsymmetrical, mitoses, and that some of the idioplasm2 is thereby lost, while idioplasm which had previously been in the background now comes to the front.

Hansemann does not consider the anaplasia in itself sufficient to produce malignant neoplasms, but emphasizes that a special factor, agent, or irritant is necessary in addition to cause the anaplastic cell to proliferate into a tumor. This agent has been supplied in the argument of those who hold the view of the parasitic origin of cancer. The efforts to demonstrate characteristic hacteria as causes have been in vain. The protozoa have been blamed as the cause of cancer, but most careful researches of many competent observers have resulted in the consensus of opinion that the curious enclosures thought to be protozon are degeneration products of cells and nuclei enclosed by leucocytes and lymphocytes.

It is a characteristic of malignant tumors that cells of other types than the original are never involved in the growth-a pavement epithelial cancer never involves cylindrical epithelia. This necessi-

¹ Virchow's Archiv, Bd. exix. p. 321.

² Idioplasm. In biology a term introduced by Nägeli for a special hereditary reproductive substance not contained in the body of the cell, but in the chromosomes of the nucleus controlling and determining the actual characters of the particular cell, and also those of all or its descendants. Each idioplasm is composed of several or many ids, which are capable of growth and multiplication by division; although much smaller in bulk than the rest of the living substance of the cell or body (trophoplasm), idioplasm is the active element in the process of formation, and determines the detailed construction of the trophoplasm, which is the passive element .- Gould's Dictionary of Medicine.

tates the assumption, if we adhere to the bacterial hypothesis, that every kind of malignant tumor must have a particular species of parasite as its cause. Our understanding of the pathogenesis of tumors is made difficult by trying to apply the bacterial theory in its explanation.

A schema which should indicate that a neoplasm which corresponds to a certain type is benign and another that looks different is malignant is a conception that becomes impossible with closer and careful study of their growths. We should never approach a tumor with the question, "Is it a carcinoma or a sarcoma?" But the diagnosis should be developed like that of the disease in the living subject. First, we must consider the anatomical properties; second, the topographical; third, the distribution of the various tissue types in the tumor, and, fourth, the properties and peculiarities of the cells. Then, if at all, the diagnosis follows naturally of itself.

If the question is to make a diagnosis from a fragment of an organ separated from the body, we must first ask ourselves the question, "Is this a real tumor or is it an inflammatory proliferation, a simple hyperplasia, or infective tumor?" Theoretically it would seem easy to distinguish the inflammatory tumor from neoplasms, and yet there are cases where considerable difficulties arise, and, indeed, a confusion may occur in two ways: first, when a real neoplasm is taken for an inflammatory proliferation; second, when the latter has the appearance of a genuine neoplasm. The first danger is most easily avoided by very careful and thorough observation. It often happens that the stroma of the tumors is developed so greatly or infiltrated with small cells to such a degree that the real parenchymatous islands are only discovered after a protracted search. This is on record as having occurred with the scirrhi, which for a long time were classed with the fibromas or inflammatory thickenings.

Hansemann gives an interesting description of sections made from excisions of the vaginal portion of the uterus. The preparations gave a strong impression of a granular proliferation strongly infiltrated with cells. Newly formed vessels were everywhere present, which were filled with leucocytes, and the whole picture was flooded with leucocytes to such an extent that at first nothing was seen but these. It was only after a more thorough examination that he found groups of cells rich in protoplasm which were in several places arranged like epithelia, and were very different from the swollen endothelia. Without doubt it was a cancer.

The cancerous portions are also easily overlooked in old indurated ulcers, and a long series of preparations must first be made before we can arrive at a certain diagnosis. It happens much more easily that inflammatory neoplasms are considered malignant tumors.

Both epithelia as well as connective tissue substances may form such great proliferations by means of inflammatory changes, which may show such a cellular composition that considerable practice and experience are necessary not to confound these with cancer and sarcoma.

In January, 1900, I came into possession of a specimen of intestinal tissue from a case of intussusception. At the tip of the invaginated part there was a circular swelling almost as thick as a finger, which might have been mistaken for a malignant tumor, and consequently as the cause of the invagination. The microscopic examination showed this not to be the fact. The thickening consisted of plentiful connective tissue with elastic fibres and fatty tissue. It was manifestly a case in which the intestinal wall and the serosa were thickened by inflammation.

Extreme difficulties arise when the endothelia have led to especial proliferation. It very often occurs in simple inflammation in various portions of the body that these cells increase to such a degree that the microscopic image shows a distinctly alveolar construction. This is found especially often in the pleura if a thick callosity is formed. But I have observed this alveolar structure in a benign neoplasm of the ileocrecal valve, and in one of the ileum. Whether at this place the mass of the cells take their origin from the epithelia of the pleura or intestine, or from the lymph-endothelia, has been the subject of much discussion. This point Hansemann does not consider as yet decided. They have, however, often been considered tumors.

In this connection two interesting cases are described by Hansemann. In both cases trauma had preceded. In one case the cheek had received a blow from a beam, in the other a rusty nail had penetrated the hand and remained there for some time. In the course of the succeeding weeks a small tumor developed in each case, and these tumors were very similar. They consisted of large spindle cells and round cells, rich in protoplasm, with tender intermediate substance, scanty stroma, and very abundant pigment. In the tumor of the cheek the pigment lay everywhere between the cells, and, therefore, arose from the bleeding caused by the blow. In the other case, however, the cells had taken up the pigment, and thus a complete similarity with a melanosarcoma arose. However, the pigment had one property which is not observed in melanosarcoma, it had a strong iron reaction, and, therefore, it was reasonable to assume that the pigment arose from the rust of the nail, and had been taken up by the cells. The simple extirpation of both tumors caused a permanent cure.

Proliferations of the connective tissue may not only have the appearance of real tumors, but inflammation may accompany the pro-

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liferation of the epithelia. Friedländer has devoted a noteworthy treatise to these, and characterizes this growth of the epithelia as an atypical proliferation. They are found extremely frequently in the various chronic inflammatory processes of the epidermis, which also accompany proliferations of the connective tissue and the formation of granular tissues. The border of the epithelium grows deep down into the granular tissue on the edges of chronic cellulites of old ulcers, in lupus, etc., branches off in different ways, and finally forms lumps and nests of epithelial cells. They contain many mitoses and also often pathological and atypical forms. In many cases the similarity to cancers may thus become so great that a mistake may very easily be made. Hansemann¹ has seen cases in which a differentiation from real cancroids was no longer possible in the coarse structure of the proliferations and in which the clinical development demonstrated its nature. In other cases the diagnosis was made possible at once by the knowledge of the condition which this investigator designates as "anaplasia." Hansemann takes this opportunity to point out especially the similar state of affairs in the larynx and at the vaginal portion of the uterus. Proliferations of the epidermis are often found so extended in the larynx, especially in tuberculosis, more rarely in syphilis, that the perfect structure of cancroids is formed. If, in such cases, the entire larynx can be sectioned, tubercles will always be found somewhere, which will render the diagnosis possible. If, however, only an excised specimen is at hand during the examination, the diagnosis becomes extremely difficult, or even impossible. (At the vaginal portion of the uterus the so-called erosions may cause a similar confusion. do not consist of wound surfaces, as has been heretofore assumed, but of islands of cylindrical epithelium which has forced itself from the neck of the uterus between the normal pavement epithelium of the vagina. Such conditions are found in small children, and are probably inherited.) Later on, if inflammation arises here, or if the vaginal portion of the uterus is injured during birth, the cylindrical epithelia sometimes grow downward like a hose and assume a striking similarity to destructive adenomas, into which they may really develop. On this account it is the more important to know that certain histological proliferations exist which bear the greatest similarity to cancers, and yet are not cancers. It is very probable that all these cases of cancroids said to have been cured by internal remedies are such atypical proliferations of the epithelia.

TUBERCULAR TUMORS. Infectious tumors of the stomach and intestines are occasionally confounded with sarcomas. As a rule, it is not difficult to differentiate an intestinal retroperitoneal or omental tuber-

cular tumor from a sarcoma. Yet I have seen cases where such tuberculous masses acquired such an extent and showed such a structure that they are not unlike sarcomas. Virchow himself at one time classed tuberculous tumors of cattle (perlsucht) among the sarcomas, on account of their fibrous structure, their cellular development, and their frequently scanty caseation. Similar perlsucht-like knots, resembling bovine tuberculosis, sometimes occur in man in the peritoneum and the pleura.

Hansemann¹ described two pulpy retroperitoneal glands, as large as the fist, without tubercles, with a minimal caseation and few tubercle bacilli. The characteristic giant cells are probably seldom found wanting in these affections. Tubercle bacilli are also present, but often in such small numbers that they are not discovered under the microscope. The transmission, however, usually succeeds on guinea-pigs, which in such cases always succumb under the form of tuberculosis peculiar to them.

ACTINOMYCOSIS of the stomach and intestines may present tumors at the operation or at autopsy which outwardly may simulate malignant neoplasms, but microscopic examination, as a rule, shows the characteristic structure (globules) of the fungus actinomyces.²

TYPHOID PROLIFERATIONS. If the neoplastic indurations of enteric fever (abdominal typhoid) should be encountered at operation or necropsy, they can be recognized without difficulty when fragments thereof are examined under the microscope. Only in cases of lymphoma of the liver might a possible confusion with malignant tumors arise.

The purely lymphatic character of the same characterize them well enough to distinguish them from sarcomas; they might possibly be confused with leukæmic or syphilitic proliferations. Sometimes melanosarcoma in the intestines forms similar ulcers of a strongly gummatous appearance, like typhoid in its early stages. If the amount of pigment contained in them is considerable, this alone suffices for a macroscopic differentiation. These melanotic proliferations also are not confined to the Peyer's patches and the follicles. Otherwise, however, the histological appearance of these sarcomas is so characteristic that they cannot easily be confused with the lymphatic proliferations of typhoid fever.

The gland tumors of the plague have recently been thoroughly investigated by Aoyama, and his investigations have been confirmed by Hansemann. The clinical progress of this disease probably rarely necessitates a differential diagnosis between these tumors and sarcomas. It is well known, however, that in all epidemic diseases, and especially at the close of an epidemic, rudimentary cases of plague occur which

may then lead to difficulties in the diagnosis. According to Aoyama and Hansemann, the buboes of the plague show a proliferation of all three component parts of the lymphatic glands—of the lymphocytes, of the endothelial and of the connective tissue lattice-shaped cells. At the same time great hyperemia, accompanied with hemorrhages, exists at first. Later on necrosis occurs in the tissue, and also suppurative softening. Finally the glands may become fibrous, hardened knots. The bacteria are present in great numbers in the glands, and may easily be detected by means of aniline colors, but not by Gram's method. Generally we are confronted with tumors which are not unlike typhoid lymph glands, only of an excessive size, and which can easily be distinguished from malignant tumors by their histological structure.

In a report from the United States Treasury Department, entitled "Bubonic Plague," by Walter Wyman, Surgeon-General Marine Hospital Service, it is stated (page 36) that intestinal plague is very rare, and Dr. H. F. Müller, in his valuable monograph "Die Pest," states that the anatomical changes in the digestive tract are not important in this disease. The mesenteric and solitary glands may be swollen, but they never acquire the size of deserving the name of tumors. In the stomach there are superficial hemorrhages. Wilm describes the solitary follicles as swollen and reaching the size of a bean. The Peyer's patches were hyperplastic but not ulcerated. It is evident from these quotations that even in countries in which the plague occurs epidemically it rarely effects striking changes in the digestive tract, and should they occur they are not likely to be confused with malignant neoplasms.

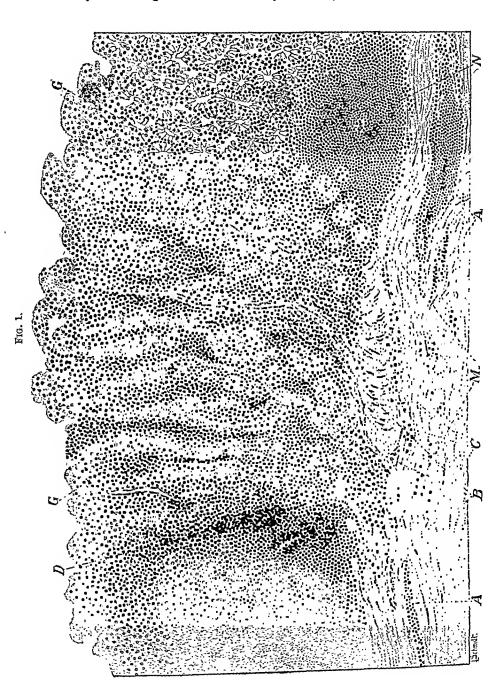
Leukemia, Pseudoleukemia, Syphilis. These diseases may present difficulties for the differential diagnosis from malignant neoplasms. They may all give rise to the formation of large tumors. Leukemia and pseudoleukemia do not differ from each other in the microscopic pictures of their tumors. In both the tumors of the lymphatic glands are composed of typical lymphatic cells. However, the follicles, the proliferating centres of the lymphatic glands, have disappeared. The cells are slightly larger than the normal lymphocytes and show numerous mitoses of the typical form of the lymphocytes. Also in the infiltrations of the tissues of the kidneys, spleen, liver, and testicles the typical lymphocytes are everywhere found. Growing over into neighboring tissues and spreading out beyond an organ by means of propagation, they are never observed, and the constituent parts of the infiltrated organs are not destroyed, but only pressed as under mechanically. It is for this reason that a liver or a kidney

¹ Nothnagel's Spec. Path. u. Ther., Bd. v. p. 41.

² Hygen. Rundschau, 1897, p. 222.

that has been completely infiltrated by syphilitic neoplasms, for instance, may yet function completely, and that neither uremia nor jaundice usually appears as a result of the leukemic proliferations pure and simple.

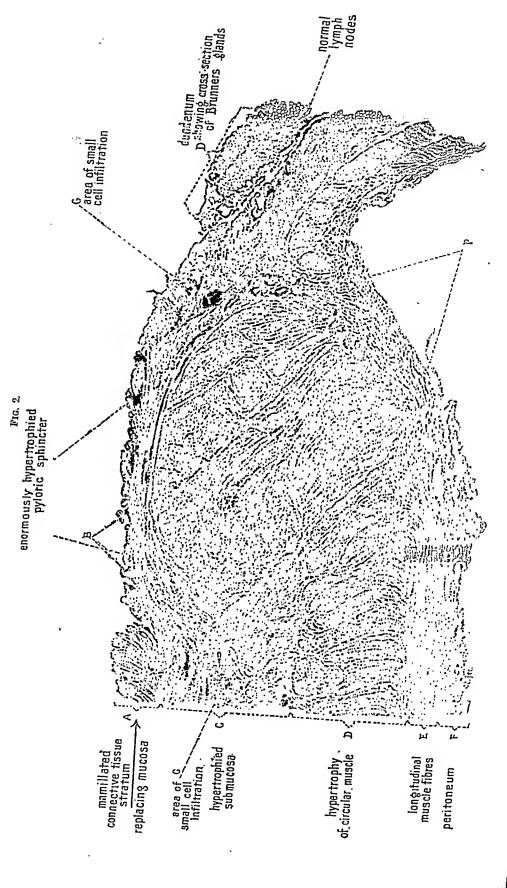
The ordinary syphilitic gumma of the gastro-intestinal canal (Fig. 1) can usually be distinguished without any difficulty from sarcomas, even



if they have assumed considerable proportions in the liver, lymphatic glands, or at other places.

Difficulties may arise for the macroscopic, but not for the microscopic, examination, which reveals either the typical granulation tissue, if it is in a fresh condition, or if retrogression has set in it shows a caseous and fatty detritus surrounded by strongly marked cicatrices. A number of German pathologists have described a syphilitic sarcoma (sarcoma syphiliticum, see Hansemann, loc. cit., s. 194), the diagnosis of which is more difficult, since the clinical development is very similar to that of a malignant tumor. Beginning at one place and afterward appearing at others, recurring after extirpation, its frequently great resistance to syphilitic remedies—all these puzzling factors should cause the histologist to approach these tumors with a critical conservatism. Macroscopically the extensive fat metamorphosis and the caseation are very noticeable. And even if all the tumors are not in this state of regressive metamorphosis, there are nevertheless some which are thus constituted, and which finally break up entirely into a fatty pulp. Those places which still remain usually show the perfect structures of a soft large-cell sarcoma, in which the very abundant, finely reticular tissue strikes the eye, and in which the larger cells are embedded somewhat loosely, so that they can be brushed out to a certain extent. At the same time single tumors can usually be found which do not possess this great cellular development, and which appear as typical gummas. From this it follows that, after some practice, the case as a whole will be recognized as syphilitic, but that single extirpated tumors often do not permit a diagnosis which consequently reaches only a certain degree of probability. Naturally only the large round-cell sarcomas can give rise to error, not the spindle-cell sarcomas, the melanosarcomas, and the sarcomas with a specific parenchyma, as the osteosarcomas, chondrosarcomas, gliosarcomas, and those with giant cells. It is stated by some authors' that cancer-like formations may also arise from syphilis, or that there are actual syphilitic cancers. Hansemann denies this altogether, and asserts that these carcinomalike developments could only be cases of atypical proliferations of the

^{- 1} Hansemann. Loc. cit.



epithelia in syphilitic ulcers or tumors. The relatively frequent occurrence of real cancers in individuals who are or were syphilitic, he assumes to be only a chance coincidence.

It is evident from the above (Fig. 2) that the exclusion of infectious tumors is not always an easy matter, but let us assume that these have been excluded, and we find that we are dealing with a real tumor, the most important question arises for the examiner, "Is the tumor malignant or not?"

The most reliable criterion of malignancy is the metastases. must, above all, hold to that idea of malignancy which is given by the occurrence of metastases, and bear in mind that the metastases may commence before separate knots have been formed, distinct from the primary tumor, but according to Hansemann, we may speak of metastases even when single, viable cell groups have separated from the primary proliferation and lie embedded in the deeper tissue, that is, when the tumor has become heteroplastic, in the sense of Virchow. (Heteroplasia, from ἔτερος, other, and πλασις, shaping, meaning the presence of tissue or cells that may or may not be normal in a part where they do not normally belong.) But even this is not necessary for the diagnosis of gastric malignant neoplasms. On the contrary, it is sufficient if it is proved that the proliferation has broken beyond the boundaries of the starting tissue (gland cells in adenocarcinoma) downward. To be sure, it is hard to determine in many cases where the boundaries of many organs are to be looked for, since these boundaries may be displaced with the increase of the proliferation. A sarcoma of the tonsils and of the lymphatic glands has gone beyond the boundaries of the organ when it grows into the muscular tissue; a sarcoma of the bone-marrow has done the same when it has pierced through the bone. But a wart on the skin grows not only upward and outward, but also downward; it displaces the lower boundaries of the epidermis, and yet it is not a cancer. We should rather keep here to the criterion of the disintegration of the neighboring parts. If the epithelia possess a membrana propria, this disappears. The lymph spaces approach the tumor cells in an entirely open manner, and it can be seen that these heteroplastic cells are pressed into the lymph spaces. crowding of heteroplastic cells into the lymph spaces and the ensuing new formation of connective tissue and vessels give rise to the alveolar structure—beneath the original surface. This heterotopia has already been emphasized by Virchow, and is considered the most deciding

1 Virchow's Archiv, Bd. iii.

Fig. 2.—Hypertrophic stenosis of the pylorus from chronic syphilitic gastritis. Section through hyperplastic pylorus and comparatively normal duodenum.

factor in the diagnosis. While I agree with Ribbert and Hansemann in assigning considerable importance to metastasis as a criterion of malignancy, I do not wish to uphold this phenomenon as an invariable test, for even benign tumors, myomas, and chondromas have been known to form metastases.¹

The most experienced teachers of pathological histology advise examination of the tissue first with low powers of the microscope. In examining sections of neoplasms of the gastro-intestinal tract, the muscularis mucosæ is, as a rule, my landmark. Any proliferation of epithelial cells around a gastric ulcer, for instance, which has extended downward along the peptic ducts and broken through the "muscularis mucosæ" I am in the habit of considering malignant. At the same time I admit that gastric adenocarcinoma may develop from cells normally located, and that dislodgement of cells from their normal site is not necessary for the origination of such a cancer, though it may be the rule.

Hansemann asserts that by a study of the pathological reversion in neoplastic cells, which he has termed "anaplasia," it is possible to recognize malignancy in the absence of heterotopia. In the following I shall try to represent the characteristics which he conceives are essential to make up anaplastic cells. He has undoubtedly merited the gratitude of pathological histologists for having first called attention to the "undifferentiation," though it is occasionally not observable in the original or mother tumor, and in my experience, as a rule, becomes evident, if at all, in the metastases. It is well to bear in mind that during anaplasia no new kind of cells are developed which might be considered peculiar to themselves, but that it is essentially a return or reversion to a stage of earlier development, from which Ribbert believes2 that they develop still further in the direction of embryological growth. Pathological reversion to an embryological state and anaplasia have the same significance for proliferation of tumor cells. Concerning Hansemann's statement that malignant tumors of the stomach have occurred which caused death and no heterotopia was recognizable microscopically, I must say that in a very large experience with gastric malignant neoplasms no such case has come to my observation. gastric malignant tumors examined at operation or autopsy by myself showed heterotopia.

The most difficult histological diagnosis of stomach tumors has, in my experience, been encountered in deciding between chronic hyperplastic gastritis and scirrhus. On two occasions I was unable to make this differentiation from pieces excised from gastric neoplasms during operation. In one case operated by Dr. L. McLane Tiffany the gastric

neoplasm was not larger than the size of a half-dollar, had thickened the entire pyloric ring, and no metastases were visible as far as the abdominal incision permitted me to see. I favored the view that it was a hyperplastic gastritis. Yet at the autopsy it proved to be a scirrhus, for the fibrous, dense stroma contained a few narrow rows of cancer cells (cancer bodies) running parallel with the dense connective tissue. There was also a metastasis in the liver, larger and softer than the original tumor, and five small nodules in the omentum.

The proliferation of the great majority of cancers in the digestive tract starts from the surface, cylindrical, or columnar epithelium, or from the gland cells. Hansemann asserts that carcinomata of the stomach occur, which cause death without having ever penetrated downward. This author also refers to the extensive carcinomatous destruction at the vaginal portion of the cervix, in which all the cancer cones are still connected with one another, and with the lower surface.¹ Twice I observed the same condition in the intestines, others report this state in the peptic ulcers and in cancroids of the esophagus. It represents a growing down into the deeper layers while maintaining a real continuity with the surface, not only a microscopic continuity. These are real cancers without heterotopia of the cells. If a diagnosis is to be made in such a case we cannot start from the coarse, structural image, but we must view the morphological change in the cells themselves, if such change is at all discoverable. At this stage of affairs Hansemann insists that we must investigate the anaplastic changes in cells if we want to attain a diagnosis at all in such cases.

To recognize the condition of anaplasia in tumor cells is not as easy a matter as Hansemann would persuade us to believe. It was emphasized before, in this connection, that only the positive result is of any importance for the diagnosis, that the absence of certain characteristic appearances does not necessarily exclude cancer. To recognize anaplasia of cells we must bring in array all possible factors which may influence the process. It is especially necessary for this that the histogenesis of the tumor be determined or that this be reasoned out from its form and location. It is also necessary to know accurately from experience all the morphological, physiological, and especially the formative properties of the parent cells. Then the form of the tumor cells should be especially compared with those of the parent cells. Then we should try to form a conception of the life-history of the tumor cells, how they appear in their youthful condition, how they develop, if and how they finally die. This should also all be compared with the fate of the parent cell. Then we should try to

find out as much as possible about the functions of the cells, from the histological picture—whether the secretion is a normal one, an increased, weakened, or changed one. Furthermore, if they form an intercellular substance, and if this corresponds to the normal one of the parent tissue, that is, fibrous, osseous, or cartilaginous, lumpy or otherwise.

Finally, we come to the nucleus—segmentation figures—the karyo-kinesis or mitosis. As to the pathological forms more directly, I may repeat that the simple occurrence of hyperchromatic, abortive, or other pathological mitoses is of no importance at all for the diagnosis. If however, such pathological mitoses are abundant and considerably heaped together, we can assume with tolerable certainty that a malignant tumor exists. This is not a physiological necessity, but a matter of experience, that a larger collection of pathological mitoses (nucleussegmentation figures) occurs only with malignant tumors. It would, therefore, be theoretically possible that this should occur also in cases of benign tumors, but Hansemann claims to have never observed it. The presence of atypic mitoses in benign tumors is reported by Lubarsch (loc. cit.), and undeniably does occur, but it is the exception, not the rule. In all benign tumors, however, the pathological mitoses are few and isolated. Of course, there are malignant tumors in which very few pathological mitoses are found. The number of the mitoses is of no importance whatsoever for the kind of the tumor, and it would be entirely erroneous to desire to conclude from a collection of mitoses at all that the proliferation is malignant. In reality it denotes a rapid increase in the cells, and is everywhere found where tissue grows rapidly or is rapidly degenerated. A small number of mitoses are also sometimes seen in malignant tumors if a momentary stoppage of the growth has taken place.

The most important diagnostic factor of the mitoses has always been the variation from the normal forms of the mother-tissue. If such differences are found, it is a sure sign of anaplasia. To avoid every misunderstanding, however, Hansemann repeats that it is not the question of one figure or of another, but that a change must have taken place in the physiological mitoses throughout if one wants to decide upon an anaplasia. Only the positive result is of value, the negative has no value whatsoever.

All observations of mitoses have reliable value only when made on faultless material. In specimens obtained by washing the stomach, post-mortem changes frequently make this part of the examination impossible, since the nuclear forms change very easily, and also because their number decreases. But by my method of gastric curettage with a stomach-tube (see Hemmeter, Diseases of the Stomach, third edition) specimens may be obtained in a fresh condition, showing in some cases

of gastric carcinoma an abundance of abnormal mitoses. At times, however, and more frequently than generally supposed, pieces showing the actual structure of carcinoma are thus gained.

In many cases the determination of the regressive metamorphoses in the parenchyma may be of importance. All malignant tumors show an especial tendency toward disintegration, and especially cancers, which are situated on the surface, almost always form ulcers. But it must be remembered that such a metamorphosis also occurs in benign tumors, for instance, in myomas, and that the syphilitic tumors undergo an excessive fat metamorphosis accompanied by caseation. This property of malignant tumors is only to be utilized for the diagnosis in connection with the entire structure, and in itself is not conclusive. Only in those cases in which it presents a form which is not peculiar to the parent cells under other conditions does it point to the anaplastic changes of the cells.

changes of the cells.

Accordingly, Hansemann emphasizes that it is possible to diagnose malignancy from the parenchyma of tumors alone. This is not true for all cases, but for many. Practically there is little opportunity or necessity to make use of studies of anaplasia for the diagnosis of neoplasms of the digestive tract. Moreover, the importance of these changes as diagnostic and pathogenetic factors has been lessened by the critical logic of Lubarsch (loc. cit.), Ribbert (loc. cit.), and others. Specimens gained at operation or autopsy, as a rule, permit of a diagnosis, from the presence of heterotopia and metastases, in my experience. The stroma in itself however furnishes no argument for the diagnosis of maligin itself, however, furnishes no argument for the diagnosis of malignancy, and only when it accompanies the parenchyma does it complete the histological picture from which was derived the definition of cancers and sarcomas. It must be repeated here again specially that the infiltration of the stroma does not form a basis for the diagnosis, since there are both cancers and benign neoplasms without such infiltration, and benign inflammatory proliferation with it. A number of times I have observed that in portions of adenocarcinoma of the stomach that were derived from the glandular layer the stroma was made up of connective tissue, but in pieces from the muscularis the stroma was composed entirely of muscle fibres. This shows that the stroma may vary, according to the heterotopia.

Cancers of the mouth, esophagus, stomach, intestines, and rectum, therefore, are diagnosed: 1. According to their structure. 2. Their

therefore, are diagnosed: 1. According to their structure. 2. Their topographical conduct toward neighboring tissues. 3. According to the properties of the parenchyma in comparison with the parent tissue. On the other hand, the concept of sarcoma is somewhat more arbitrary. There are some, to be sure, which we recognize in the same way as cancers are recognized. These are the neoplasms presenting a specificity in the structure of their parenchyma—the chondrosarcomas,

osteosarcomas, myogliosarcomas, and lymphsarcomas. The others, however, are characterized by their structure alone, by the development of their cells and the formation of an intercellular substance. In four cases I encountered sarcomata of the intestines with indifferent spindle or round cells, the comparison of which with the parent cells was impossible; malignancy had to be determined by the topography of the same, that is, from the heterotopic development of the tumor. advance of the tumor into neighboring tissues is what gives the decision alone, for the diagnosis of malignancy. The more the tumor is developed, the easier the diagnosis. But just at the first stages, when a decision would be most valuable, the characteristic criteria very often are lacking, and we must content ourselves with a probable diagnosis. M. Borst suggests that it will always be better in such cases to make the prognosis worse rather than better. This statement cannot well be harmonized with that of Virchow, that there are neoplasms of such perplexing structures that they may be designated as sarcomas or something else, just as the observer pleases.

While we can yet form diagnoses, with tolerable certainty, of the two forms of tumors, cancers, and sarcomas, the malignancy of complex tumors is exceedingly uncertain, and only to be diagnosed from the anatomical picture when its malignancy has already become manifest, that is, when real metastases have been developed. It is well known that all these tumors have occasionally become malignant. however, they should at one time remain confined to their primary position, at another go beyond it and form metastases, is entirely beyond our discernment. No such judgment is possible from the histological structure. However, mixed tumors of the kidneys and nterus are always malignant, and such tumors in some other organs always become malignant if they exist for some time. To this class belong the papillary cysts of the kidneys and ovaries, besides the tumors growing from parts in the neighborhood of the kidneys to the kidneys themselves, which finally spread to the vena cava and form metastases throughout the body.

One of the most striking phenomena of all malignant tumors is the very widely differing degree of their malignancy, which fact has been meutioned several times. There are even cancers which exist ten years or more without revealing their malignancy in the shape of metastases. The question may be asked, "Can any deductions be made from the histological structure concerning the degree of malignancy?" The study of anaplasia might furnish a starting point for this, for from it we see without a doubt that those cells which have most increased in the power of independent existence must also most easily give rise to the formation of metastases. Since this is expressed by the degree of variation from the parent tissue a certain parallelism

ought to exist between the degree of anaplasia and the degree of malignancy. In order to control this question, Hausemann made the following two series of observations. At one time the metastases and recurrences were compared with the primary tumors, and it was seen that they showed the same or a greater degree of anaplasia than the primary tumors, never a less degree. Furthermore, tumors with very extended dissemination through the entire body show strong anaplasia; such with uncommon local extension, without dissemination, show slight anaplasia. There are few exceptions to this law. For theoretic consideration Hansemann considered this law proved in general; the greater the anaplasia the greater the tendency to form metastases. The second series of observations was concerned with carrying this theory over into practice. For this purpose he made notes as to the degree of anaplasia and the consequently expected tendency to recurrences of metastases. These prognosticated data were, as far as possible, controlled and compared with the later real course of events. The result was as follows: If the tumor was found to be very anaplastic, recurrences and metastases were hardly ever lacking. If, however, the tumor was but slightly anaplastic, either no recurrence or metastases occurred, or they developed with greater or great anaplasia. not yet been discovered on what fact it depends that a tumor becomes more anaplastic, and, therefore, the prognosis in all such cases is doubt-Here, also, strong anaplasia gives more information than anaplasia which is slight or not discoverable at all.

My personal experience, as far as the practical application of this theory to the relative frequency of recurrences or metastases in cases of gastro-intestinal neoplasms is concerned, is that in all of my cases of this sort recurrences were recorded in from one to three years after the operation. I mean in all cases, of course, the future history of which could be traced up; that is, in forty-eight out of sixty operated cases.

I included in this list only such cases at which no metastases were visible at the operation.

The factors necessary to constitute anaplasia are not readily comprehended or recognized. 1. The establishment of the histogenesis of the tumor from its form and localization. 2. An accurate knowledge of the morphological, physiological, and formative peculiarities of the mother cells. 3. Comparison of the forms of tumor cells with those of the mother cells. 4. The biology—i. e., life history of the tumor cells—their youthful appearance, their growth, their decline and death. 5. Determination of the function of the tumor cells, whether they secrete or not. 6. Character of the intercellular substance and its comparison with that of the mother tissue. All of these factors demand much critical discernment, large casuistic experience,

and patient judgment, so much so that the study of anaplasia is practically impossible outside of pathological laboratories.

Before concluding I desire to call attention to the gastric adenoma originating on the basis of a gastric ulcer. It is a well-known fact of pathology that the human gastric or peptic ulcer may become transformed into an adenocarcinoma apparently spontaneously. This process has been described in a classical investigation by Hauser.

In 1900 I paid a visit to Prof. Hauser's laboratory at the University of Erlangen, and was fortunate enough to see some of his original preparations and sections. I have also had a rather exceptional clinical experience with cases of gastric ulcer in the human being, which I had studied in one case for over two years, during which it presented the typical clinical history of gastric ulcer. Then followed the clinical history of gastric carcinoma and death. Naturally the question arose in my mind: "If gastric ulcers could be produced experimentally in animals, their transmission into possible adenocarcinoma might be studied at will, or the transformation into adenocarcinoma might be attempted by the transplantation of malignant neoplasms derived from other animals of the same species, or by the injection of sterilized filtrate of ground-up adenocarcinoma of other animals of the same species into the tissues surrounding the edge of the ulcer."

Among the causes that are definitely ascertained as contributing to the bringing about of gastric ulcer are especially three: 3 1. Impaired vitality or injury to the mucosa of the stomach. 2. Hyperacidity or super-secretion of gastric juice containing an excess of HCl and proteolytic ferments. 3. An altered state of the blood.

All three of these factors may be produced artificially, and when we do produce them in the laboratory on animals, peptic ulcers arise in such a large proportion of the animals thus experimented upon that we have a right to conclude that they are directly attributable to the method pursued. When I speak of peptic gastric ulcer I mean the typical "Chronisches magengeschwür" as described by Hauser. For defects can be produced in the dog's stomach, for instance (and the literature on the experimental production of gastric ulcer proves this conclusively), which are not true gastric ulcers, but simply ulcerating lesions which heal rapidly. Gustav Fütterers has produced such lesions by applying to the stomach caustics, ligating the gastric arteries, cutting off the supply of nutrition by stitching large portions of the mucosa

¹ Das chronische Magengeschwür, sein Vernarbungs-Process und die Beziehung zur Entwiek elung des Magencarcinom, Leipzig, 1883; and Das Gylinder-epithelearcinom des Magens und des Dickdarms, Jena, 1890. See also Hemmeter, New York Medical Record, 1897, vol. lii., p. 365. Also Hemmeter, Diseases of the Stomach, 3d ed., p. 560.

² Hemmeter. New York Medical Record, 1897, loc. cit.

<sup>Bemmeter. Diseases of the Stomach, 3d ed., p. 491.
Loc. cit.
Ueber die Aetiologie des Carcinoms, p. 115.</sup>

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with catgut sutures. Defects resulted, but they all healed in a short time. Even when one-third of the quantity of the animal's blood was withdrawn, such defects had healed in two weeks. In 1896 Silbermann produced gastric ulcers in dogs by either tying the gastric arteries or causing emboli in them by injecting suspensions of lead chromate. Thereafter he injected hæmoglobin and pyrogallic acid (acid pyrogallic 0.1 to 0.14 per cent.). When Fütterer resected the gastric mucosa, as stated before, and made injections of pyrogallic acid, he could confirm Silbermann's results and produced ulcers of the stomach which in every histological detail corresponded to the chronic gastric ulcer of the human being. By this method, employed by Fütterer and Silbermann, I was successful in producing experimentally gastric ulcers. In one series of experiments eleven dogs out of thirty operated upon developed typical gastric ulcers.

Now I had a method by which this characteristic lesion could be produced experimentally. The next question was: "Could these lesions be in any way experimentally transformed into adenocarcinoma of the stomach, or would they become transformed into adenocarcinoma spontaneously, as has been definitely known to occur in the human being, and as Fütterer has observed, to occur in a rabbit in which he had artificially produced a gastric ulcer by the method described?"

Hauser has described a structural characteristic of the adenocarcinoma of the stomach, which has developed on the basis of a gastric ulcer, and which is not observed in ulcerating carcinomas not developed on this basis. This characteristic, by which the so-called "ulcuscarcinomatosum" can be recognized, consists in a very peculiar behavior in the fibres of the chief muscular layer of the stomach, and also of the fibres of the muscularis mucose. This peculiar behavior of the muscularis consists in an oblique ascension of the fibres of the true muscular layer, and a descension of the fibres of the muscularis mucosa, the fibres of both muscular layers converging toward and fusing into each other in front of the edge of the ulcer, which is here composed mainly of connective tissue. The true muscularis bends upward in continuity, and the border of the ulcer, which is composed of very dense connective tissue, is limited by the lower surface of the turned-up true muscularis. Another feature of the ulcus carcinomatosum is that a section made perpendicular to the surface of the stomach, and through the entire bed of the ulcer, almost invariably exhibits the general outline of a fish-hook.8

For the causes which bring about this fish-hook formation (see Fütterer, loc. cit., p. 112), the main reason being that the lower edges of

¹ Hemmeter. Intracellular Catalytic Processes in Pathogenesis of Malignant Neoplasms. The American Journal of the Medical Sciences, April, 1903.

² Loc. cit., p. 152.

³ Hemmeter's Diseases of the Stomach, 3d ed., Plate IX.



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the ulcer, near the pylorus, are, during the efforts of the gastric peristalsis to evacuate the gastric chyme into the duodenum, exposed to the most mechanical irritation, and accordingly Fütterer has shown that adenocarcinoma, if it develops from an ulcer, always develops from the lower edge. This location for the development of gastriculcer has already been emphasized in a publication by Dr. Delano Ames and myself, but it is the desert of Fütterer to have emphasized this point as an etiological factor in the causation of ulcus carcinomatosum.

I should add that in repeating the experimental production of gastric ulcer according to the methods of Silbermann² and Fütterer,³ I not only produced mechanical defects and injected pyrogallic acid in the method described, but I maintained a very high acidity for free HCl in the gastric chyme of the dog by supplying this acid in his food, and also pouring it into his stomach through a soft rubber tube. In February, 1900, I came into the possession of a mongrel fox-terrier that persistently vomited his food. The vomit contained no free HCl nor ferments, and at the autopsy a cancer of the stomach was found near the pylorus. Transplantations with this material were made into the stomach of other fox-terriers, but I was not successful in producing a gastric carcinoma in any of these other animals inoculated.4 Dr. Leo Loeb has undoubtedly succeeded in transplanting a sarcoma from one rat thus affected to a large number of other rats of different age and sex.⁵ In my previous publication⁶ I stated that, as far as I knew, Loeb's work had not been confirmed. In a private communication Dr. Loeb informs me that Ehrlich and others confirmed his results. A sterile extract of part of this canine carcinoma was also made and preserved for inoculation and injections into the stomachs of dogs in which I

¹ New York Mcdical Record, September 11, 1897.

² Loc. eit.

³ Loe. eit.

⁴ Sepsis followed a large proportion of the operations, and I could not secure the aid of a competent surgeon who would do these operations aseptically for me.

⁵ Journal of Medical Research, vol. vi. No. 1.

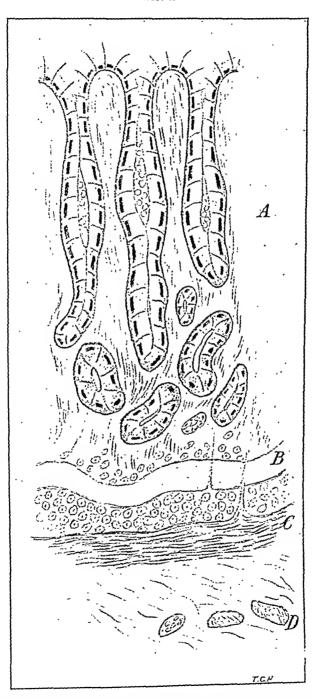
⁶ THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, April, 1903.

Fig. 3.—Ulcus eareinomatosum of the pylorus. A. A section through the wall of the stomach, showing the edge and a portion of the base of the ulcer. Objective, two-thirds; eyepiece, two inches. Stained with hematoxylin and cosin. The drawing is built up from a series of microscopic fields. X about 15 diameters. d. Mucous membrane. m. Muscularis mucose. s. Submucosa. a. Base of the ulcer. mm. Muscle coat of the stomach. mc. Groups of cancer cells between the bundles of muscle fibres. dc. Groups of cancer cells in the cdge of the ulcer in the mucous membrane. sc. Groups of cancer cells in the submucosa. a. Neerotic membrane lining the base of the ulcer.

B. A small nodule from the serous coat of the stomach over the base of the ulcer. Objective, two-thirds; cye-piece, two inches. Stained with hematoxylin and eosin. × about 15 diameters. This figure gives a good idea of one of the nodules in the serosa. It is composed entirely of a collection of groups and masses of cancer cells so closely packed that the outlines of the individual cells cannot be made out. Except for these nodular thickenings, the scross was not altered. pc. Cancer masses in peritoneal coat.

expected to cause gastric ulcers. A very small quantity of filtrate (148 c.c.) was thus saved, as the largest part of the tumor had been used for transplantations.

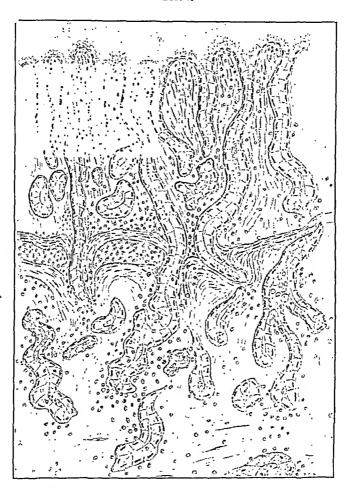
Fig. 4.



Normal gastric mucosa of dog. A. Glandular layer. B. A homogeneous layer characteristic of canine and feline stomachs. C. Muscularis mucosa. D. Submucosa with few muscle bundles.

In the meanwhile the publications of Fütterer appeared, and it occurred to me that possibly my failure to successfully transplant canine carcinoma was due to the fact that the stomach of the animal into which the inoculation was made was not in a susceptible condition, and that it must be transformed into such a condition by a

Fig. 5.



Adenomatous proliferation at edges of experimental gastric ulcer caused by injection of sterile and cell-free extract of gastric adenocarcinoma of a dog. A. Surface of gastric mucosa. B. Peptic gland ducts. C. Muscularis mucosæ. D. Proliferating gland ducts that have broken through the muscularis mucosæ. E. Gland cells in submucosa.

previous injury. This previous detriment to the tissue, in order to secure successful transplantation of the tumor, in the case of rats, has not been found necessary by Leo Loeb² and Herzog.³ I did not succeed in securing another dog affected with carcinoma of the stomach

¹ Loc. cit,

² Journal of Mcdical Research, vol. viii. p. 44.

³ Ibid., p. 74.

until after I had read Fütterer's work in 1901, and this second dog presented an adenocarcinoma which developed spontaneously at the edges of an experimental gastric ulcer. It presented the behavior of the two layers of the gastric muscularis as first described by Hauser, had a distinct fish-hook form, and exhibited heterotopia of gastric glands as first described by Virchow and Hansemann. This gastric cancer reached the size of a walnut, and two metastases were found in the peritoneum.

The practical deduction for the histological diagnosis for malignant tumors which can be made from the studies of Hauser, Fütterer and myself, is that it is possible to diagnose a carcinomatous ulcer of the stomach histologically by the characteristic behavior of the true muscularis and muscularis mucosæ, and by the form of a fish-hook presented in outline in a section through the edge of the ulcer nearest the pylorus. By these striking features I believe we are justified in concluding that any gastric adenocarcinoma presenting them has been developed on the basis of a pre-existing gastric ulcer.

In the April number of this JOURNAL I have reported the results of my experiment attempting the transformation of experimental gastric ulcer into adenocarcinoma by injecting the extract of a canine gastric carcinoma into the edges of the ulcer. Very striking adenomatous proliferations can be produced in this way, but they cannot be called carcinomas. I include here the photographs of some of the sections, showing these experimental adenomas.

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¹ His' Archiv, Bd. iii.

SYPHILIS OF THE TRACHEA AND BRONCHI.

AN ANALYSIS OF 128 RECORDED CASES AND REPORT OF A CASE OF SYPHILITIC STENOSIS OF THE BRONCHI.

By Lewis A. Conner, M.D.,

PROFESSOR OF CLINICAL MEDICINE IN THE CORNELL UNIVERSITY MEDICAL COLLEGE;
ATTENDING PHYSICIAN TO THE HUDSON STREET HOSPITAL, NEW YORK.

THE observation of an obscure case of pulmonary disease which the autopsy showed to be one, primarily, of syphilitic stenosis of both bronchi, was the occasion of an investigation into the literature of the subject of syphilitic manifestations in the bronchi.

It was soon found, however, that a separation of the cases of syphilis of the bronchi from those of syphilis of the trachea could not with propriety be made, since both in their clinical and in their pathological aspects the conditions seemed identical, and since both were frequently found associated in the same subject. Accordingly, an attempt has been made to collect and analyze as many as possible of the recorded cases of syphilis of the trachea and bronchi. A few cases have been omitted in which there seemed reasonable doubt as to the accuracy of the diagnosis or in which the records were too incomplete to be of value.

No instance of the occurrence in the trachea or bronchi of the initial lesion of syphilis has, so far as I can discover, ever been recorded. Observations, also, as to the appearance in the trachea of the secondary manifestations are confined to a very few cases. Schroetter asserts that he has never seen condylomata, macules, or papules in the trachea. Lancereaux states that secondary lesions are very rare, and are seen as disseminated areas of hyperæmia of the mucous membrane in the form of violet-red spots which disappear rapidly. Morell Mackenzie has seen mucous patches in the trachea only five times.

Not only are these tracheal manifestations of secondary syphilis extremely uncommon, but they are also fleeting in character and have apparently little or no clinical significance. For all practical purposes, then, the lesions of syphilis in the trachea and bronchi may be said to be confined to those late and severe manifestations known as tertiary.

These tertiary syphilitic conditions of the trachea and bronchi, however, have, it seems to me, an importance quite out of relation to their great rarity for the reasons, first, that in almost every recorded case they have gravely threatened life, and in most cases have actually caused death; and, second, that from a study of the cases it seems quite evident that a very large proportion of them are curable if they can but be recognized and treated early.

HISTORICAL. Although the occurrence of ulceration in the trachen, without associated lesions in the lungs or larynx, had been recognized

earlier (Cayol⁴), the first case of disease of the trachea or bronchi ascribed to syphilis seems to have been that of Munk. In the London Medical Gazette for 1841, p. 210, he describes the case of a man who had syphilis for eighteen months before death, with various severe manifestations, including ulceration of the soft palate. The necropsy showed many minute ulcers in the mucosa of the larynx, none in the trachea, but many in the bronchi, especially in the smaller ones. In the following year (1842) Worthington⁵ reported a carefully observed case of stricture of the trachea which he believed to be syphilitic, and in 1843 O'Ferrall,⁶ of Dublin, reported one of extensive lesions of the epiglottis and trachea which were clearly syphilitic, although he does not so state. Both of these latter cases present classical pictures of the disease in both its clinical and its pathological aspects.

In the same year Watson,⁷ of New York, recorded a case of syphilitic ulcer of a bronchus, with sudden, fatal hemorrhage.

Within the next few years several cases were described in Germany. In 1848 Waller³ reported four cases. A decade later three cases were observed in Paris (Moissenet, Vigla, and Charnal¹¹), and from that time on cases multiplied. Wilks¹² (1863) recorded four instances, and Türck¹³ five more. Gerhardt, in 1867, reported five cases and gave a summary of the clinical features which, even at the present time, can hardly be added to or improved upon.

In 1878 Vierling¹⁵ was able to collect and tabulate 46 cases. I have now endeavored to bring together all such of the earlier cases as are not included in Vierling's table, and as many as possible of the cases reported since that time. These 82 cases, including my own, have been tabulated and analyzed, and the results are here recorded, together with a list, in chronological order, of the cases and a very brief statement of the salient features of each. These cases will be referred to by their Roman numerals. Reference to Vierling's table will be indicated by the letter V. before the number of the case.

MORBID ANATOMY. In 117 of the 128 cases of both series, the character and seat of the lesion could be determined; in 97 by autopsy, in the remaining 20 by laryngoscopical examination. The lesions found, while varying exceedingly in character and extent, may be conveniently grouped into four classes:

- 1. Gummatous swellings-circumscribed or diffuse.
- 2. Ulcers-single or multiple.
- 3. Endotracheal connective tissue new-growth—(a) distinct scars; (b) diffuse thickening.
 - 4. Fibrous peritracheitis.
- 1. Of the first class (gummata) there were in all 20 cases (17 per cent.). Eighteen of these occurred in the present series. Of these 18 cases there were 11 (VIII., XIX., XXX., XLI., XLV., LVI.,

LVIII., LX., LXXIV., LXXVIII., and LXXX.) in which the gummata were circumscribed. Most of these were seen during life by laryngoscopical examination and showed as rounded, red, tumor masses projecting into, and sometimes almost filling, the tracheal-lumen.

In 8 cases these tumors were single. One case (LVI.) showed the trachea from the fourth ring downward studded with numbers of irregular nodular swellings, some firm, some soft, some ulcerating. In Case LX. a large gumma was found at autopsy astride the point of bifurcation.

Some of the gummatous swellings (XIV., XXVI., XXXII., XXXVII., LIX., LXX., and LXXII.) instead of being circumscribed extended over considerable areas of the tracheal wall, and sometimes involved the whole circumference. These are described usually as of reddish color and as showing fibrinous or purulent exudate upon the surface. Two of these (XIV. and XXVI.) showed some superficial ulceration.

2. Ulcers were found in 27 of the present list of cases, and in 24 of Vierling's (44 per cent. of all cases). In 10 of the 27 cases the ulcers were single. These were, as a rule, large (an inch or more in diameter) and deep. Munk's case (I.) showed many small ulcers in the larynx, none in the trachea, but a great many in the large and small bronchi.

The ulcers showed all possible variations in size, contour, depth, position, etc. Usually they were quite deep, penetrating to the submucous layer, and, in many instances, even to the cartilages. In a number of cases these latter have been found necrotic and partly destroyed.

In several cases (e. g., in IV.) fragments of cartilage have been coughed up from time to time.

Perforation of the entire tracheal or bronchial wall occurred in 12 cases and usually with disastrous results. Thus, in 5 of these cases there was fatal hemorrhage from erosion of some large bloodvessel.

In two instances (V. 32 and V. 42) an ulcer in the right bronchus perforated a branch of the right pulmonary artery. Once (II.) there was erosion of a branch of the bronchial artery by an ulcer in the left bronchus. Once (XXV.) the aorta itself was perforated, and once also the superior vena cava (L.). Perforation of the esophagus occurred in two instances (XXIII. and LVII.). One perforation of the trachea (V. 11) resulted in a fatal mediastinal abscess. In Cases XXXIX. and LII. perforation resulted in peritracheal abscess, which in LII. caused serious tracheal compression below. In Case LXXV. erosion of the tracheal wall resulted in the curious condition known as "tracheocele."

The appearance of many of the ulcers gave evidence of no tendency toward healing. In other cases scarring was in process; in still others

- (e. g., LVII.) cicatrization was found in the central portions, while at the periphery the ulcerative process was active. The edges of the ulcers in some cases were thickened and everted; in others undermined and overhanging. In general the ulcers showed a tendency toward circular outlines.
- 3. Endotracheal Fibrous Tissue. (a) Distinct scars were found in 25 of the present series of cases, and in 22 of Vierling's—in all 40 per cent. These showed the same variations that were found in the ulcers. Most frequently they were radiating or star-shaped. Often they formed prominent bands of dense tissue projecting into the lumen and running in various directions—transversely, longitudinally, even spirally. In three cases (XXVII., XXXIII., and XLVI.) they formed distinct membranous bands which acted almost like diaphragms.

In Gleitsmann's case (XXXIII.) laryngoscopical examination revealed two antero-posterior membranous bands opposite the fifth or sixth cartilage, with only a narrow slit between them. The appearance was that of a second glottis. Schroetter (XXVII.) at one time saw a tracheal ulcer with some beginning constriction; two mouths later the ulcer had healed, but the scar had formed a membranous stricture of extreme grade.

In Case XLVI. Masseï saw in the trachea at the third ring a diaphragm-like membrane, with an oval opening near its centre, admitting only a No. 12 or No. 13 French catheter. This was made of two membranous folds extending from the tracheal walls and uniting everywhere except at the opening.

(b) In 13 of the cases (11 per cent.) the lesion found at autopsy was a diffuse connective tissue infiltration of the tracheal or bronchial wall within the cartilages—an "obliterative endotracheitis" or bronchitis, with marked diminution of the lumen. This growth involved the whole circumference of the wall and frequently covered several centimetres in length. It is doubtful if many of these thickenings had been preceded by ulceration. The proliferation of connective tissue seems rather to have begun in the submucous coat. In 2 of these cases, at least (XX. and LXXXII.), this fibrous endotracheitis was associated with an extensive peritracheitis as well. As regards the location of these lesions, in 1 case (XVII.) the lower part of the trachea alone was involved, in 4 cases (XXXVIII., XLVII., LIV., and LXII.) both trachea and bronchi were affected, in the remaining cases the lesion was confined to one or both bronchi.

Case LIV., one of inherited syphilis, furnished the most striking example of the condition. The thickening of the wall began abruptly one and a half inches above the bifurcation, with diminution of the lumen to one-third of its normal size by enormous production of fibrous tissue within the cartilages. The epithelial covering was, for the most

part, intact. The same condition was found in both bronchi, the left being almost occluded. Parker, in describing this case, gives to the condition the name "obliterative endotracheitis."

4. Not the least interesting of the lesions of tracheal and bronchial syphilis are the masses of dense fibrous tissue which have occasionally been found to develop *outside* of the cartilaginous rings.

Of this group no examples can be identified among Vierling's cases, but in the present series there were 8 (XX., XXXII., LVI., LXII., LXVI., LXVII., LXXVII., and LXXXII.). Of these all but 1 (LXXVII.) were combined with endotracheal lesions of some sort.

This development of peritracheal fibrous tissue was seen usually about the lower end of the trachea and about the main bronchi. One or all of these tubes would be encased in a dense mass of fibrous tissue which frequently involved other adjacent structures and in particular the recurrent laryngeal nerves.

In 1884 Gougenheim and Leval-Piquechef¹⁶ called attention to the chain of small lymph nodes lying deep in the neck between the trachea and the esophagus, and extending from the larynx to the roots of the lungs, which they found regularly enlarged in tuberculosis. Lécureuil¹⁷ thinks it probable that the peritracheal inflammations of syphilis originate as gummatous processes in these nodes, and that these processes may terminate in dense fibrous tissue entirely surrounding, and often constricting, the trachea and bronchi.

These nodes lie in close relation also to the recurrent nerves which seem so frequently to be involved in the peritracheal inflammation.

Of the 8 cases of peritracheitis here cited, involvement of one or both nerves occurred in 4. In Cases XXXII. and LXII. both nerves were affected; in LVI. the left nerve; in LXVI. the right. In another case (LXIII.), with symptoms of tracheobronchial syphilis, which died without autopsy, the existing paralysis of both posterior cricoarytenoids was attributed to the same cause.

In 3 of the 8 cases the enlarged lymph nodes were recognized as a part of the peritracheal mass. In Case LXVI. a distinct tumor mass $5 \times 4 \times 2$ cm. in size was found partly surrounding the trachea at its upper part, intimately adherent and causing compression and constriction. The mass enclosed the right recurrent nerve, was caseous in places, and had begun to ulcerate into the trachea—the cartilages being bare and eroded. In all the other cases the lesion was much more diffuse and involved the entire circumference of the tube. Two of the observers (LVI. and LXIX.) were struck with the many points of correspondence between these diffuse fibrous strictures of the trachea and the syphilitic strictures of the rectum.

The distribution of the syphilitic lesions may be seen from the following table:

								- (Cases.	Percentage,
Involvement of upper third of trachea alone									23	19.7
**	middle "		"						2	1.7
**	lower "	- (1.8						18	15.3
**	large area of		**						23	19,7
11	trachea and hroncl	ıi.							38	32,6
**	both bronehi alone						·	·	5	4.2
11	right bronchus alo	ne							4	3.4
"	left "					•			4	3.4
	Total .								137	100

From this table it will be seen that the trachea alone was diseased in 56 per cent. of the cases, the trachea and bronchi together in 33 per cent., and the bronchi alone in 11 per cent. The great rarity of lesions of the middle part of the trachea, as compared with those of either the upper or the lower end, is also made apparent. The table does not, however, bring out clearly the great frequency of lesions at, or just above, the bifurcation.

In almost all the cases in which both trachea and bronchi were affected the tracheal lesions were located chiefly at the lower end—a fact which was noted and emphasized by Gerhardt.¹⁴

Associated Lesions. Larynx. In Vierling's table of cases the larynx is recorded as being diseased in 63 per cent. In the present series it was involved in only 12 per cent. of the cases. This wide difference in the relative frequency of laryngeal involvement in the two series of cases it is difficult to understand. Altogether the larynx was found the seat of syphilitic lesions in 30 per cent. of the cases.

Gerhardt and others have intimated that the association of laryngeal syphilis with that of the trachea was especially common when the tracheal lesions were located at its upper part, but an analysis of the cases hardly supports that view. The frequency was almost as great when the disease was confined to the lower part of the trachea or to the bronchi as when it was at the upper end. Laryngeal involvement was most common, however, among those cases in which the tracheal and bronchial lesions were extensive and severe.

Mouth, Nose, and Throat. Evidence of old or recent syphilis in the palate, nose, or pharynx were recorded in 16 (about 20 per cent.) of the present list of 82 cases. In 6 of the 16 cases (37 per cent.) there were also lesions in the larynx. These figures would seem to suggest that there existed a closer relation between syphilis of the upper air passages and that of the larynx than between disease of the larynx and that of the lower air passages, since in the same series laryngeal involvement was found in but 12 per cent. of the cases of tracheobronchial syphilis.

Lungs. Autopsies were made in 56 of the present series of cases and revealed the following pulmonary changes:

In 10 cases (18 per cent.) lesions believed to be characteristic of

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syphilis were found (IX., XX., XXVIII., XXXI., XXXII., XXXVIII., LVI., LXVIII., LXX., and LXXIX.). In all of these, except XXXII., there existed interstitial pneumonia of greater or less extent. In 2 cases (XXXII. and LVI.) distinct gummata were found.

Evidences of old tuberculosis were seen in 3 cases (VI., XVII., and XXXI.).

In 19 of the cases pneumonia, more or less extensive, was present.

This in seven instances was described as lobar pneumonia; in the remaining twelve either as lobular or bronchopneumonia. Many of these latter were clearly cases of inhalation pneumonia.

In 3 other cases the lungs showed congestion; in 1 case (XXXIX.) "splenization at both bases;" in 1 case (XXIV.) a gangrenous cavity in the left upper lobe.

Emphysema is mentioned as being present in only 9 of the 56 cases (VI., XII., XVII., XXXIV., XLVII., LI., LV., LXXIX., and LXXXII.). This surprisingly small proportion is probably far from representing the real frequency of emphysema in this condition, as the autopsy reports in many cases were very meagre with respect to the state of the lungs.

Dilatation of Trachea and Bronchi. Among the 97 autopsies of both series dilatation of the trachea was found three times (XVII., XXIV., and V. 15). In each of these instances it occurred above the point of stricture.

Dilatation of both bronchi was found in 9 cases (V., VIII., XX., XXII., XXIV., XXXV., XXXVIII., LV., and LXXXII.). One bronchus alone, or its branches, showed dilatation six times (IX., LII., LXX., LXVIII., LXXIX., and V. 12). In other words, there was bronchial dilatation below the lesions in 15 per cent. of the autopsies. The character of the dilatation differed greatly in the different cases. Commonly it was cylindrical and involved not only the main bronchi but their branches as well. In some cases it was described as universal. Less frequently the dilatation was circumscribed and confined to the area immediately below the stricture.

It is not possible here to enter into a detailed discussion of the causation of such bronchiectases. The surprising thing is not that they occasionally occurred, but that they should have been found so infrequently. In all but a few of the cases (perhaps 15 per cent.) obstruction of some sort existed, and yet dilatation was found in only 15 per cent. of the autopsies. That is to say, in not more than 20 per cent. of the cases of permanent stenosis did bronchiectasis occur. It seems evident, therefore, that the tracheal or bronchial stenosis is not the chief determining cause of the bronchiectases found. Much more potent factors, probably, are the changes occurring in the bronchial

wall and in the adjacent lung tissue by which the muscular and elastic tissue of the bronchi, upon which their strength and resilience depend, is replaced by inflammatory tissue.

The autopsy records upon this point are, for the most part, very unsatisfactory, but certain interesting facts are nevertheless developed. Case LXVIII. showed stenosis of the trachea and right main bronchus; there was also interstitial pneumonia of the right lower lobe. Dilatation was confined to those branches of the right bronchus which led to the diseased lower lobe.

Case LXX. Moderate obstruction in trachea; main bronchi not stenosed; interstitial pneumonia in left lung. Dilatation of bronchi running to left lower lobe only.

Case LXXIX. Stricture of left main bronchus; dilatation of bronchus beyond stricture and of branches running to left upper lobe, which is sclerosed. Branches to left lower lobe not dilated.

In 1 case (LV.) there was general dilatation of the bronchi, although no stenosis was found and no obstructive symptoms had been present.

INCIDENCE. Age. The age in 112 cases is shown by the following table, arranged in decades:

0 to 9 years		. 4 cases.	40 to 49 years		. 26 cases.
10 to 19 "		. 9 "	50 to 59 "	•	. 9 "
20 to 29 "		. 15 "	60 to 69 "		. 5 "
30 to 39 "		. 43 "	70 to 79 "		. 1 "

The youngest case was that of a child, aged fourteen months, reported by Woronichin¹⁸ (V. 45). The age of the oldest case (LXIX.) was seventy-three years.

Sex. Among the 120 cases in which this point could be ascertained there were 68 males and 52 females—57 per cent. and 43 per cent., respectively.

DURATION OF SYPHILITIC INFECTION. The time of the appearance of tracheal symptoms in relation to the duration of the general syphilitic infection varied enormously.

In 31 cases of acquired syphilis in which the point could be determined, the average duration of the syphilis was ten years. The shortest duration was nine months (XI.); the longest, forty-two years (LXVII.). In another case (LI.) the infection had occurred forty years before.

During this intermediate period syphilitic manifestations of some sort are mentioned as having occurred in 20 per cent. of the present series of cases. In over half of these the manifestations were seen in the throat or larynx.

Inherited Syphilis. In 10 cases (VIII., XVIII., XXIX., XXX., LIV., and V. 14, 35, 39, 40, and 45) the lesions were ascribed to inherited syphilis. The average age of these 10 cases was ten

years. The 2 oldest cases were, respectively, twenty and nineteen years (V. 14 and 39).

SYMPTOMATOLOGY. Since, as has been said, distinct obstruction in the trachea or bronchi occurred in all but a few of the cases (in all about 85 per cent.), the symptoms, for the most part, have been those of tracheal or bronchial stenosis.

Gerhard t^{14} long ago noted that the symptoms could be divided into three stages:

- 1. Stage of irritation.
- 2. Stage of permanent stenosis.
- 3. Stage of suffocative attacks.

These three stages can, without doubt, be recognized in many of the cases, although the symptoms of the first stage have often been so slight as to pass unnoticed or at least unrecorded.

EARLIEST SYMPTOMS. The frequency with which the early irritative stage exists may be seen from an analysis of the cases with regard to the first symptoms noticed.

Among 69 cases of the present series in which that point could be determined, cough was the earliest symptom in 41. That is to say, in 60 per cent. of the cases a stage of irritation, as evidenced by the cough, was observed before any symptoms of obstruction appeared.

In 9 cases cough and dyspnœa together were given as the first symptoms. Twelve times dyspnœa alone was the first indication of trouble.

In a few remaining cases the first symptoms varied greatly. In 2 (II. and L.) the condition was latent until sudden, fatal hemorrhage, from ulceration and erosion of a bloodvessel took place. In one instance (LVIII.) the first and prominent symptoms were pain and tenderness referred to the upper part of the trachea. In 1 (XXX.) aphonia and dysphagia from laryngeal ulceration are mentioned as the first symptoms. In 1 (III.) there was a sudden suffocative attack requiring tracheotomy.

Finally, in Case X. attention was first called to the condition by friends of the patient who noticed a stridulous breathing sound.

DURATION OF SYMPTOMS. In the 58 cases in which the records were satisfactory upon this point the duration of the symptoms was as follows:

In 1 case (LXII.) the symptoms extended over a period of three years. In several instances they lasted for two years or more.

Individual Symptoms. Cough. Among the 77 cases of this series in which the symptoms were recorded, cough was noted in all but 12 cases. It was therefore present in 84 per cent. of the cases at least.

Usually, as has been said, it appeared as the first symptom, and in many cases it remained a prominent one throughout the disease.

In 33 cases the character of the cough was not mentioned. In six instances it was described as dry; in twelve, as accompanied by expectoration. In 9 other cases the cough was at first dry and later showed expectoration. Once it was described as worse at night; once as paroxysmal; five times as harsh and distressing, and once (LXXIV.) as resembling the cough of thoracic aneurism.

Sputum. This is mentioned specifically in only 30 of the 77 cases (40 per cent.), although doubtless it occurred more frequently. It is described variously as mucous, mucopurulent, purulent, fetid, blood-stained, nummular, etc. Blood-stained sputa were seen in 8 cases. In Case XL., which completely recovered, both connective tissue and elastic fibres were found in the sputa. In 1 case (IV.) the patient expectorated fragments of the tracheal cartilages at intervals for two and a half years. In one instance (LXXVI.) one of the chief complaints was the inability to expectorate.

Hemorrhage. In addition to the 8 cases in which were seen blood-tinged sputa, free hemorrhage from the trachea or bronchi occurred in 6 of the present list of cases, and at least twice among those of Vierling's series. In 6 of these 8 cases the hemorrhage occurred from some large vessel and was immediately fatal. Thus:

Case II. Ulcer of left bronchus, with perforation of branch of bronchial artery.

Case XXV. Ulcer of lower part of trachea, with perforation of arch of aorta.

Case L. Ulcer of lower part of trachea, with perforation of superior vena cava.

Case LXIII. Signs of tracheo-brouchial syphilis. Fatal hemorrhage. No autopsy.

Case V., 32. Ulcer of right bronchus, with perforation of branch of pulmonary artery.

Case V., 42. Ulcer of right bronchus, with perforation of branch of pulmonary artery.

Dyspnæa This seems to have been the most constant, as well as the most conspicuous, of all the symptoms. In only 2 of the 77 cases (XXXVI. and LV.) is there a statement that it was not present. In five instances no mention of it is made. In all the other 70 cases (90 per cent.) it was present at some time.

Usually this difficulty of breathing appeared early (in 12 cases it was the first symptom), increased steadily, and occupied the foreground in a clinical picture as alarming and distressing as can well be imagined.

Concerning the type of dyspnea (whether chiefly inspiratory or expiratory) the reports are very unsatisfactory. Whenever references

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are made to this point, it is in connection with a description with the stridor present. The matter will, therefore, be discussed under that heading.

The dyspnea presented itself in two distinct forms—constant and paroxysmal.

1. Constant Dyspnæa. Continuous, progressive dyspnæa, as distinguished from distinct paroxysmal attacks, was present in all but 2 of the 70 cases. In these 2 the disease showed itself in the form of sudden and severe paroxysmal dyspnæa. In all the other cases the onset was more or less insidious—a gradually developing breathlessness, at first, perhaps, only upon some exertion, but sooner or later becoming continuous and progressively worse.

This second stage of Gerhardt—that of permanent stenosis—varied in length between a few weeks and two or three years.

2. Paroxysmal Dyspnæa. At some time in the course of the disease, in half of the 70 cases with dyspnæa, there were added paroxysmal attacks of the most alarming air hunger, with orthopnæa, cyanosis, stridor, inspiratory sinking in of the tissues of the neck and epigastrium, rapid, feeble pulse, and sometimes even unconsciousness.

In 2 cases (III. and XII.) these suffocative attacks developed suddenly without any preceding constant dyspnæa. In all the other cases they appeared only after the other symptoms of dyspnæa and cough had been present some time.

Gerhardt's third stage, therefore, could be seen in 44 per cent. (34 out of 77) of all the cases. These attacks in some instances were of almost daily occurrence. In others they appeared only at long intervals. They were excited usually by some special exertion, such as climbing stairs, by attacks of coughing, or even by eating (LXXIX.). In 5 cases the attacks were especially prone to develop at night.

The suddenness and severity of some of these suffocative attacks seem wellnigh incredible. In Case XI., for example, the first symptom was an attack which followed the exertion of running quickly up a flight of stairs. This was followed by many other paroxysms of a similar character in which the patient would be for many hours unconscious, pulseless, and with barely perceptible respiration. Between these attacks she would be quite well.

In no less than 11 cases did the patient die in such a suffocative attack.

That permanent, organic stenosis of the trachea or main bronchi is sometimes accompanied by dyspnœa altogether or chiefly paroxysmal and intermittent has long been recognized, and was emphasized especially by Worms¹⁹ in the report of his case (X.).

The explanation of this curious fact requires a consideration of the effects in general produced by permanent narrowing of the larger

tubes. Such studies of the influence upon respiration of a narrowing of the trachea have been made by different observers from both experimental and clinical standpoints, and the matter is discussed at length by Grossmann²⁰ in his admirable article on tracheal stenosis.

Grossmann calls attention to the fact that dyspnœa of two distinct sorts can be recognized; first, that with slow, abnormally deep breathing, and, second, that in which the respirations are rapid and shallow. In the first type the equilibrium is restored by the depth, in the second by the frequency of the respirations.

It has been found, both clinically and experimentally, that in tracheal stenosis there is, for a time at least, slowing and deepening of the respirations, slowing of the pulse rate, and an increase in the blood pressure in both the systemic and the pulmonary circulations.

The result of this is that the work of the heart is much increased. So long as the heart, by greater activity and hypertrophy, can fully meet this increased demand upon it, compensation is maintained and the subjective evidences of dyspnæa may be lacking altogether.

It is to the failure of such compensation by the heart that Grossmann attributes all the disturbances in the further course of tracheal stenosis. He compares the effect upon the heart in such conditions to that produced by bodily overexertion—e. g., in "soldier's heart," etc.—and says that the clinical picture and course of the disease are the same in both cases—i. e., that of cardiac insufficiency.

The post-mortem findings, also, he thinks, give support to this view—passive congestion of the liver, spleen, and kidneys, together with dilatation of the heart (and in particular of the right ventricle), and a marked engorgement of the lungs.

This engorgement of the lungs seems to take part in the production of further dyspnæa in a very interesting way.

The distention of the alveolar capillaries from the engorgement is believed to produce a rigidity of the lungs which seriously interferes with their respiratory expansion and contraction. Von Basch,²² who advocates this idea, found that in animals engorgement of the pulmonary capillaries could interfere with the expansion of the lungs to such an extent that the difference between inspiration and expiration could scarcely be appreciated.

In this way is the vicious circle made more complete, and to the tracheal dyspnœa added the more serious, progressive cardiac dyspnœa. The slow, deep respirations are replaced gradually by rapid and shallow ones, the pulse becomes rapid and feeble, and the picture then becomes that of grave cardiac insufficiency in which, however, certain evidences of the primary stenosis (stridor, etc.) are usually still to be recognized.

To return now to the cases where intermittent, paroxysmal dyspnœa is the conspicuous symptom of permanent stricture of trachea or

bronchi. It is the usual history of such cases, as has been said, that the attacks of dyspnæa follow directly upon some special exertion, such as stair climbing, attacks of coughing, etc. If we imagine in such cases that, by reason of deeper and slower respirations and more vigorous heart action, respiratory and cardiac compensation has been maintained, but only just maintained, in spite of the stricture, it is easy to see how some comparatively slight exertion might add sufficient work to the already overworked heart to upset the delicately adjusted Then to the slight, and, perhaps, altogether unnoticed, constant dyspnea would be added the paroxysmal attack. The failure of cardiac compensation would be followed by failure of respiratory compensation which would show itself in the form of a suffocative attack. Under the absolute rest made necessary by such an attack it is also easily conceivable that the heart should gradually regain its equilibrium, and that the paroxysmal dyspnœa should be replaced by the slight, and purely tracheal, constant dyspnea. In the same way any transient inflammatory swelling of the mucous membrane of the trachea and bronchi, which might temporarily still further diminish the lumen, would cause increased labor for the heart, and might, therefore, precipitate such an attack of paroxysmal dyspnœa.

Rate of Breathing. In the reports of cases of syphilis of the trachea and bronchi very little can be found concerning the actual rate of breathing. In most of the cases where the rate is definitely stated the condition of stenosis had existed for some time, and, to the purely tracheal dyspnæa, there had been added that due to cardiac insufficiency; so that the respiratory rate has usually been above the normal. In many of the cases, however, although the number of respirations to the minute is not mentioned, the comparative slowness of the breathing is implied by the statement that each inspiratory act was greatly prolonged. Finally, in a few cases the respiratory rate is given as distinctly below the normal. The most striking example of this is seen in the case of Worthington's (almost the first case reported), in which, owing to the great prolongation of the inspiration, the whole breathing act occupied a period of about ten seconds—the respirations averaging not more than six to the minute.

Stridor. Among all the symptoms of tracheo-bronchial syphilis none is perhaps so conspicuous and striking, when present, as the peculiar stridulous sound which, in so many of the cases of stenosis, accompanies one or both respiratory acts. Its occurrence among the 77 cases whose symptoms are here analyzed may be tabulated as follows:

Stridor, then, was mentioned as present in about 50 per cent. of the cases. As the reports are, in some instances, decidedly meagre in the details of the symptoms, it is very probable that this figure is somewhat below that of its actual frequency.

Among the 21 cases in which the respiratory time of the stridor is definitely stated, it will be seen that in 12 the sound occurred with inspiration alone, and in 8 only, with both inspiration and expiration. In most of these latter cases, moreover, the stridor is spoken of as having been more intense with inspiration than with expiration. No instance is given in which this rule was reversed. In some cases the sound has been only inspiratory during quiet breathing, but upon any exertion has been audible during expiration as well.

In only one of the cases was the stridulous sound present with expiration alone. In this case (XI.), which in some respects is unique, the dyspnea as well as the stridor was almost altogether with expiration, and was due chiefly to the valve-like action of a large piece of eroded cartilage which, with expiration, would be lifted up and would almost completely close the tracheal lumen.

It may safely be concluded, I think, from all this, and from the fact that the marked prolongation of inspiration is commented upon in so many of the reported cases, that with syphilitic stricture (as with other forms) the dyspnæa and the stridor are regularly most distinct with inspiration, and that very commonly they are evident only during that part of the breathing act.

It is evident that the intensity of the stridor will depend not alone upon the size of the stricture, but, as well, upon the length and vigor of the respirations, and that, cæteris paribus, the deeper and more powerful the inspiration the more pronounced is likely to be the accompanying sound. If this be the case we should expect the stridor to be most marked in the cases where the dyspnæa due to the stenosis had not yet been augmented by that due to a failing heart; in other words, where the respirations were still slow and deep, rather than rapid and superficial.

A study of the cases seems to support this assumption, although the lack of detail in many of the histories makes it difficult to reach a definite conclusion.

It is certain that not every case of stricture is accompanied by stridor. In Case LI. the symptoms were those only of emphysema; there was no stridor whatever, and yet the autopsy showed, in addition to emphysema, a considerable stricture of the trachea and great narrowing of the left bronchus. In Case LVI. the symptoms were entirely pulmonary, no evidence of tracheal stenosis being present, but the autopsy revealed many gummatous swellings and bands of scar tissue throughout the trachea.

In Case XX. the clinical picture was that of chronic pulmonary phthisis, although both bronchi were shown, post-mortem, to have been greatly contracted. In Case LVIII. a gummatous tumor in the upper part of the trachea, which almost filled its lumen, gave rise to no stridor.

On the other hand, in Case LXIV., Gairdner observed, in addition to slight, constant dyspnæa and cough, attacks of paroxysmal dyspnæa, accompanied by inspiratory stridor. At the autopsy there was found a very large ulcer involving almost the whole circumference of the lower end of the trachea and extending into the main bronchi, but no mention whatever is made, however, of any stenosis of either trachea or bronchi.

Concerning the character of the stridulous sound, the descriptions differ widely. Its most characteristic form seems to be that which was first so graphically described by Worthington, who compares it to the "roaring" sound made by unsound horses. The French writers, in their term cornage, have adopted the same comparison. But the tone is by no means always "roaring" in character. Sometimes the pitch is much higher and the sound is whistling or sibilant. In some cases the writers have described it as exactly similar to the stridor produced in the larynx by paralysis of both posterior crico-arytenoids (LIX.). Indeed, in most cases, the sounds seem to be indistinguishable from those produced in laryngeal stenosis.

The *intensity* of the stridor varies greatly as might be expected. In several cases it is described as so loud as to interfere with the sleep of other patients in the ward. Sometimes it has been a faint sibilant sound scarcely audible except upon exertion. In two cases (XXXVII, and LIX.) it was especially loud during sleep.

The stridor, moreover, does not seem to depend upon the location of the stricture. It is heard when the bronchi alone are stenosed, and may be loud even when only one bronchus is narrowed (X.).

Pain. Pain of some sort is mentioned in 13 reports (17 per cent.). In 3 cases (VII., X., and XV.) it was felt as a dull, constricting feeling behind the sternum. In Case VI. pain was felt at the level of the larynx, although the lesions were located at the lower end of the trachea and in the bronchi. Twice (XXI. and LXVIII.) was the pain referred to the suprasternal notch. In the first case there was only a cicatricial stricture at the bifurcation; in the second there was extensive ulceration of the trachea between the sixth and ninth rings, as well as stricture of the trachea at the bifurcation and of the right bronchus.

In 4 cases (XXXVI., XXXIX., XLII., and LXX.) the location of the pain is not given other than as in the throat or trachea. Gnawing pain was felt between the shoulders in Case LV., in which the autopsy showed many small ulcers throughout the trachea and bronchi.

In Case LVIII. pain and tenderness just below the larynx were the conspicuous symptoms, and were due to a gumma situated in the trachea at that point. Pain and tenderness were caused at about the same point in Case LXVI. by compression from a peritracheal mass.

It seems doubtful, from a study of the cases just mentioned, if the location of the pain is of much value in determining the position of the lesion.

Tenderness. Tenderness on pressure is mentioned only three times in all. Once it was noticed over the larynx in a case (XXXIX.) in which the larynx was involved in the lesion; once there was great tenderness over the upper part of the trachea, with a gummatous tumor on the inner surface at that point (LVIII.), and once (LXVI.) over the right side of the trachea in a case with extensive peritracheal induration.

Voice. Reference to the voice was made in 34 of the cases. Among these it was found normal in 10 (30 per cent.). In 4 other cases it was clear but weak. Twice (XXXIII. and XXXV.) there was complete aphonia, although the larynx was normal. In both of these cases there was marked stenosis from membranous bands situated just below the larynx.

Aphonia occurred in 2 other cases, but in each of these there was some lesion of the larynx. In 6 cases (IX., XXXVIII., XLIV., LXVI., LXXIV., and LXXXII.) the larynx was found normal, although the voice was hourse or rough. In another case, with a normal larynx (XXXVII.), the character of the voice varied greatly; at times there would be aphonia, at other times the voice would be harsh and rough, at still others it would be quite clear.

It is evident, therefore, in tracheal and bronchial syphilis, that, even with a normal larynx, the vocal sounds may assume almost any abnormal character and may even disappear altogether, and that, therefore, a hoarse or even whispering voice cannot be taken as evidence that the obstruction is in the larynx rather than below.

Retraction of Tissues during Inspiration (Tirage). A distinct sinking-in of the tissues during inspiration was observed in 9 of the 77 cases. In most of these this was apparent not only at the root of the neck, but also in the epigastrium and along the free border of the ribs.

Movement of Larynx. Gerhardt, in his classical description of the signs of tracheal stenosis, lays much weight upon the limitation of vertical movement of the larynx in this condition as compared with that of laryngeal stenosis, and goes so far as to say "in spasmodic and stridulous breathing laryngeal movement of less than one centimetre is a certain sign of tracheal or tracheo-bronchial stenosis."

Statements concerning the mobility of the larynx can be found in only 6 of this series of cases. In 2 (XXX. and XXXVII.) the larynx

is described as not moving at all with respiration; three times (XLVII., LII., and LXXVI.) it is said to have moved only very slightly, and in 1 case (XXXVIII.) the amount of respiratory excursion is given as one centimetre. These few statements, therefore, as far as they go, support the view of Gerhardt, since in only 1 of the 6 cases was there anything more than very slight movement, and in this case the movement (1 centimetre) was considerably less than one is apt to see in conditions where the obstruction is in the larynx.

PULMONARY SIGNS. Physical examination of the lungs in the different cases gave results of the most miscellaneous character. In 12 of the cases the respiratory murmur was entirely masked by the loud stridor. In another instance it was obscured by tracheal rhonchi.

In 10 cases the signs are described as those of bronchitis. In two others (XX. and XLIX.) the pulmonary signs, as well as the clinical features in general, were those of chronic phthisis. In Case LXXIII., with stricture of the left bronchus, there was loud tubular breathing over the right chest, while the breathing was inaudible on the left side.

In a number of the cases the respiratory sounds were very feeble over both chests. Among those cases which were complicated by pneumonia there were, of course, corresponding signs. In many instances no careful description of the physical signs of the lungs is given.

MISCELLANEOUS SYMPTOMS. In a number of the cases (XX., XXXV., XXXVIII., XLII., XLIX., LV., LVI., LXVI., and LXXXI.) emaciation was a conspicuous feature. In some of these cases there were profuse sweats as well, and these, with the emaciation and cough, made the resemblance to chronic phthisis very strong. In several instances (especially in XXIII. and XXXVIII.) attacks of chills and fever were common.

Dysphagia was noticed three times (XVIII., XXXIX., and LXX.). In one of these there were lesions of the larynx as well as of the trachea. In Case LVII. a communication between the trachea and osophagus was formed by ulceration, with the subsequent entry of food into the trachea during swallowing, and, eventually, death from inhalation pneumonia.

A pulsus paradoxus was noted in 1 case (LXXXI.), with the signs of tracheal stricture.

In case LXXVI., in which both inspiration and expiration were very labored, a soft, tumor-like prominence appeared above the left clavicle, which was tympanitic on percussion and which was regarded as an emphysematous ballooning of the apex of the left lung.

Another curious and rare condition was that of tracheocele (LXXV.).

Another curious and rare condition was that of tracheocele (LXXV.). The patient, a man, aged twenty-five years, noticed the gradual development of a tumor in the median line of the neck just below the larynx,

which in six weeks reached the size of a walnut. Laryngoscopical examination showed, in addition to evidences of syphilis in the throat, an irregular ulcer on the anterior wall of the trachea. Pressure upon the tumor in the neck would cause it to diminish in size, a hissing sound could be heard in the throat, and air and fluid could be seen to enter the trachea through the ulcer.

DIAGNOSIS. For the purposes of diagnosis, cases of syphilis of the trachea and bronchi may be conveniently divided into: 1. Those without signs of obstruction to breathing. 2. Those with such obstruction.

In the first class of cases the recognition of the nature of the trouble will usually be a very difficult and often a quite impossible, task. The symptoms likely to be present—cough, pain, blood-stained sputa or free hemorrhage—are all of them common to various pulmonary conditions of much more frequent occurrence, and the suspicion of tracheobronchial syphilis could hardly be raised except by the discovery in the trachea, by laryngoscopical examination, of ulcers or localized swelling, or by the presence of such a group of symptoms in patients showing other syphilitic manifestations, and in whom the other more common affections could with reasonable certainty be excluded.

In the second class, which, fortunately for diagnosis, includes most of the cases, the question resolves itself into two parts: 1. Does tracheal or bronchial obstruction exist? 2. Is such obstruction due to syphilis?

Obstruction in the larger air passages—i. e., larynx, trachea and large bronchi—manifests itself in a clinical picture which is usually characteristic and unmistakable. This consists of: 1. A peculiar type of dyspnæic breathing, in which the prolonged, labored, and relatively slow inspiration and the shorter, easy expiration follow each other without the usual pauses. 2. A stridulous sound chiefly or altogether inspiratory. 3. In most cases an inspiratory sinking-in (tirage) of the tissues of the root of the neck, the epigastrium, and the lower intercostal spaces.

The differentiation of laryngeal obstruction from that occurring in the trachea or bronchi should present no difficulties except in cases where it is not possible to make a satisfactory laryngeal examination. These may be met in children and also in adults whose throats are intolerable to the necessary manipulations, or whose dyspnæa is so intense as to make such an examination impossible.

Even without an inspection of the larynx the differentiation can usually be made, although it must be admitted that the difficulties to be met may be very great. Careful examination of the throat, at least, can be made in all cases, with the view of excluding such obstructive conditions as retropharyngeal abscess and quinsy.

The points likely to be helpful in distinguishing tracheo-bronchial stenosis from that occurring in the larynx may be enumerated as follows:

- 1. History.
- 2. Character of voice.
- 3. Amount of respiratory movement of the larynx.
- 4. Attitude of the head during inspiration.
- 5. Location of the inspiratory thrill.
- 6. Point of greatest intensity of stridor.
- 7. Variation in the signs over the two sides of the chest.

Careful inquiry into the history of the case, concerning mode of onset, character of cough, position of pain, dysphagia, hoarseness, etc., is likely to reveal some fact of value in determining the position of the obstruction.

The character of the voice is of much less diagnostic value than might at first be supposed. As has already been shown, the voice is frequently hoarse, and may be even aphonic, in cases of tracheal stenosis with normal larynges. On the other hand, in one condition of laryngeal obstruction—that of bilateral paralysis of the abductor muscles—the voice may be quite unaffected.

The typical voice of tracheal stenosis is a light, clear one, of somewhat restricted range, and in conditions of obstruction of the large air passages the presence of such a voice would suggest that the stenosis existed at some point below the larynx. It should be borne in mind, however, that such a voice would be quite compatible with at least one form of laryngeal obstruction.

It was Gerhardt¹⁴ who first emphasized the fact that in laryngeal stenosis the normal slight downward movement of the larynx during inspiration was much increased by the impact of the inspired air against the upper surface of the obstructed glottis, and that in an effort to offset this and to afford a point of support to the larynx the head was retracted and the chin elevated. He asserted that in dyspnæa due to obstruction below the larynx this exaggerated movement of the larynx did not occur, nor was the head retracted, and he believed, therefore, that these two points furnished valuable aid in differentiating from laryngeal stenosis that of the trachea and bronchi.

Among the cases here analyzed (as has been said under Symptomatology), Gerhardt's assertion that in tracheal stenosis the larynx shows little or no respiratory movement, seems to be borne out by the records of the few cases in which the point is mentioned.

The other half of the dictum, however (that in laryngeal stenosis there is always an exaggeration of the normal respiratory movement of the larynx), rests, I think, upon a less firm basis. There is reason to believe that, occasionally at least, in laryngeal obstruction the elevation of the chin and the contraction of the muscles supporting the

larynx may be so great as not only to prevent any exaggeration of the normal downward excursion, but even to cause a slight inspiratory elevation of that organ.

Gerhardt's conclusion, therefore, that in labored and stridulous breathing a laryngeal movement of less than one centimetre indicates always tracheal or tracheo-bronchial stenosis, must be accepted with some reserve. Where the excursion is greater than one centimetre, however, there is strong presumptive evidence that the obstruction is in the larynx rather than below.

The attitude of the head and chin, likewise, seems to be not altogether trustworthy. At least Neumann²³ reports a case of tracheal stenosis, in a child, due to enlarged glands in the thorax, in which the head was retracted and the chin elevated throughout.

Careful palpation of the larynx and trachea will sometimes lead to the localization of the obstruction by the finding of the point at which an inspiratory thrill can be most distinctly felt. Such a thrill, however, is by no means always present.

In the same way the point at which the stridor is loudest may sometimes be readily determined by the stethoscope, and this will usually correspond to the point of obstruction. Where the stricture lies behind the sternum, however, the stridor might, as Gerhardt points out, be heard louder over the larynx than over the point of stricture. In this connection it should be mentioned that Aufrecht²⁴ noticed in 3 cases of stenosis of the lower part of the trachea that the normal tracheal breathing sound could not be heard in listening over the trachea with the stethoscope, and he believes this disappearance of the tracheal breathing sound to be a sign of some value in tracheal stenosis.

No difficulty should be met in distinguishing laryngeal stenosis from that of a single bronchus. The diagnosis of the latter condition can usually readily be made by a careful comparison of the signs of the two sides of the chest. On the affected side there will be found usually restricted expansion, diminished vocal fremitus, enfeebled or absent respiratory sounds, and diminished vocal resonance.

It having been determined that the stenosis is in the trachea or bronchi rather than in the larynx, there remains the often more difficult task of deciding upon the nature of the obstruction. Stenoses due to syphilis must be distinguished from those due to a great variety of other causes, some of which are of much more frequent occurrence.

These non-syphilitic forms of tracheo-bronchial stenosis may be conveniently grouped into (1) those due to compression from without, and (2) those caused by obstruction from within.

The conditions likely to cause compression of the trachea along its course in the neck, such as goitre, enlarged lymph nodes, etc., can usually be readily recognized. In the thorax, however, such compressions.

sion of the trachea or bronchi may be very difficult to demonstrate. The list of causes includes thoracic aneurism, enlargement of the tracheo-bronchial and mediastinal glands in tuberculosis, pseudo-leukæmia, etc., tumors and abscess of the mediastinum, carcinoma of the æsophagus, enlargement of the thymus gland, etc. It must be remembered in this connection, moreover, that syphilitic enlargement of the tracheo-bronchial lymph nodes may be added to the lesions of the interior of the trachea or bronchi.

Of the possible causes of obstruction operating from within there are to be mentioned:

- 1. Foreign bodies.
- 2. Simple and malignant new-growths (polypi, primary carcinomata).
 - 3. Lupus.
 - 4. Chronic glanders.
 - 5. The chronic blennorrhoa of Stoerck.
 - 6. Tuberculosis.
 - 7. Leprosy.
 - 8. Cicatrization of the ulcers of variola.
 - 9. Scars following the use of intubation or tracheotomy tubes.
 - 10. Hysterical spasm.
 - 11. Accumulations of mucus, etc.

The diagnosis of syphilitic stenosis from obstruction due to a foreign body would, for obvious reasons, hardly offer difficulty.

Mucous polyps and primary carcinomata of the trachea, while exceedingly rare, do occur and might be impossible of differentiation from syphilitic disease unless seen by the laryngoscope. A history of long-standing cough, of blood-stained sputa, of tracheal pain or tenderness preceding the signs of obstruction, together with a history of syphilis and especially of severe, late manifestations, would point toward the latter disease as the cause of the stenosis.

Regarding the appearance of tuberculous disease in the trachea, Wright²⁵ says that he can find the record of only a single case in which tuberculosis was either primary in the trachea or was confined to it to the exclusion of the larynx. A case of spasmodic stricture of the trachea, ascribed to hysteria, has been reported by Landgraf.²⁶ An instance of sudden bronchial obstruction due to the accumulation of thick mucus during an attack of acute bronchial catarrh is recorded by Deri.²⁷

Prognosis. Mortality. In Vierling's list¹⁵ of 46 cases death occurred in 39; 3 were cured, and more or less improvement was seen in the remaining 4. In the present series of 82 cases there were 58 deaths and 15 cures, while the remaining 9 were reported as improved.

The mortality among the 128 cases, therefore, was 76 per cent. The

number of cures is given as 18 (14 per cent.), while in 10 per cent. improvement of greater or less degree was recorded.

Cause of Death. Among the 58 fatal cases in the present series, death was caused in 19 by the development of some form of pneumonia. In 2 of these cases the pneumonia was the result of the inhalation of food particles after perforation of the esophagus.

In 11 of the cases death was directly produced by a paroxysmal suffocative attack. In 4 cases it was due to sudden profuse hemorrhage from perforation of one of the large bloodvessels.

In most of the remaining cases the fatal ending came as the result of exhaustion and gradual cardiac failure. In a few instances it was due to syphilitic lesions in other parts of the body or to some intercurrent disease.

The relation of prognosis to the early recognition of the nature of the affection is clearly seen among the cases of this series. Of the 15 cures 13 occurred in cases where the lesions (gummata or ulcers) could be seen by the laryngoscope, and were thus early recognized and treated. In a fourteenth case, although the laryngoscopical examination failed, the diagnosis was readily made from the presence of syphilitic manifestations in other parts of the body. In only 1 case (LXXVI.) was a cure effected where the lesions were of long standing, and where the obstruction was due to cicatricial contraction.

The prognosis bears a very definite relation also to the position of the lesions. It is evident that in general the higher in the trachea the lesions the more readily, and, therefore, the earlier, will the diagnosis be made. So also when the disease is high up in the trachea are the cases much more susceptible of successful treatment by mechanical measures.

From what has been said it is obvious that the *character* of the lesions also will greatly affect the prognosis. Gummata and ulcers, in most cases, readily respond to antisyphilitic treatment. When the obstruction is due to contracting bands of cicatricial tissue much less is to be expected from treatment by drugs.

The condition of the other organs, especially of the lungs and heart, must greatly influence the duration of life and the chances of relief. This subject has been discussed at some length under the head of Dyspnæa. So long as the respiratory acts, in cases of obstruction, are slower and deeper than normal, it is safe to assume that no serious secondary changes have yet taken place in the lungs or heart. Such pulmonary and cardiac insufficiency is usually promptly shown by a change in the character of the dyspnæa by which the breathing becomes rapid and superficial and the characteristic picture of stenotic dyspnæa is replaced to some extent by the more familiar one of cardiac dyspnæa.

TREATMENT. The results of treatment have been studied in the 82 cases which make up the present series. In only 29 of these was a rational treatment carried out sufficiently to warrant the formation of a judgment as to its efficacy. In all the other cases either the nature of the condition was not recognized or the patient was seen only after some grave complication had developed and had rendered the case hopeless.

Among these 29 cases only 3 failed to respond satisfactorily to treatment. One of these was a case of inherited syphilis in which the character of the lesion was not determined (XVIII.). One (LXXIII.) showed diffuse fibrous thickening of the left bronchus with great stenosis, and in one (LXVI.) the obstruction was due to compression from extensive peritracheal deposit (in this case treatment was begun only five days before death).

Of the other 26 cases 15 were cured and 11 showed improvement of greater or less degree. In most of the latter cases, moreover, the improvement was marked and apparently permanent.

Among the 15 cases cured the character of the lesions in the trachea could be made out in all but 1. These 14 cases included 9 (XIV., XIX., XXXVII., XLI., LVIII., LIX., LXXII., LXXIV., and LXXX.) in which the symptoms were due to circumscribed or diffuse gummata; 3 (XXVII., XXXVI., and LXXV.) to ulceration; 1 (XXXIII.) to membranous bands forming a sort of false glottis, and 1 (LXXVI.) to cicatricial stenosis of the lower end of the trachea and of the left bronchus.

The nature of the lesion in the 11 cases improved by treatment could be determined in only 4. In 3 of these (XXX., XLV., and LXXVIII.) there was a gummatous thickening of the tracheal wall. In 1 (XLVI.) a diaphragm-like membrane existed at the third tracheal ring. The very few cases of cicatricial stenosis in which relief was obtained were all (except Case XXXIII.) benefited only by mechanical measures.

As regards the details of anti-syphilitic treatment, the greatest benefit seems to have been obtained from large doses of the iodides, although some of the cures were effected by the combination of mercury and potassium iodide. Some of the early French writers (e. g., Vidal²⁸) believed that too rapid cicatrization of the uleers or gummata tended to increase the dangers of subsequent stenosis, and they took pains, therefore, to interrupt the treatment from time to time in the hope of avoiding this complication. By most of the later writers this precaution is regarded as unnecessary, to say the least, and the drugs have usually been pushed to the limit of tolerance. In 1 case (LXIV.) Ingals saw little result from 30-grain doses of sodium iodide, but when the drug was increased to 120 grains t. i. d. there was marked improvement.

Such large doses of the iodides, however, are not altogether without danger because of the sudden ædema of the mucous membrane which occasionally develops. Wright²⁵ and others have seen instances of alarming dyspnæa produced thus in cases of tracheal and laryngeal stenosis.

McKenzie²⁹ believes that cases of syphilis of the air passages have been benefited and cured by the occurrence in the patient of some acute febrile disease such as scarlatina, measles, or erysipelas. This idea is indorsed by Parrain.³⁰

In addition to the treatment by antisyphilitic remedies, satisfactory and even brilliant results have been obtained in a few cases of stenosis by mechanical means. These measures consist in: 1. The gradual dilatation of a stricture by the introduction of catheters through the larynx. 2. Such dilatation through a tracheotomy wound. 3. The use of a tracheotomy canula.

Relief was obtained by the introduction of sounds through the laryux in 3 cases. This successful dilatation of a tracheal stricture by catheterization was first demonstrated by Schroetter³¹ in a case of cicatricial stenosis following syphilitic ulceration (XXVII.). The scar of the healed ulcer formed a membranous constriction of extreme grade, which was gradually dilated by catheters and hard rubber bougies of increasing size. The patient eventually learned to introduce the catheter himself (see further account by Arnold³²), and was sent home entirely relieved, with instructions to continue the daily introduction of the catheter. (In a case also of cicatricial narrowing of the entrance of both main bronchi, believed to be due to variola, Schroetter³³ obtained considerable relief from the same method of treatment.)

The second case of syphilitic stenosis relieved in this way was that of Masséï³¹ (XLVI.). A membranous stricture, at the level of the third tracheal ring, admitting only a No. 12 French catheter, was greatly improved by gradual dilatation.

The third case of syphilitic stricture relieved thus was reported in 1895 by Seifert.³⁵ The results reached in this case are so remarkable as to warrant its citation in some detail.

A man, aged forty-three years, was sent to Gerhardt, with the diagnosis of tracheo-bronchial stenosis from gummatous cicatrization. There had been a gradually increasing difficulty of breathing for one year, shown especially upon any exertion. Antisyphilitic treatment had given only slight relief. Examination showed much slowing of the respiration, with lengthening of both acts, a loud inspiratory and expiratory stridor, inspiratory sinking-in of the epigastrium, almost complete cessation of respiratory activity over the left lower lobe, and a tumor-like bulging above the left clavicle, giving a tympanitic note on percussion. The larynx moved only slightly with the labored respirations, and the

laryngoscope showed it to be normal. In the trachea slight stenosis could be noticed at the third cartilage, and a more marked narrowing immediately above the bifurcation. A diagnosis could be made of cicatricial stenosis of the trachea and left main bronchus. The prominence above the left clavicle was believed to be an emphysematous ballooning of the left upper lobe. Seifert first dilated the tracheal stricture by means of Schroetter's bougies and obtained some relief from this. He then essayed the catheterization of the left bronchus. Beginning with a bougie of 5.5 mm. he was able gradually to introduce larger and larger sounds until he could enter the main bronchus with one of 12.5 mm. diameter. After ten weeks of almost daily catheterization the patient was discharged in excellent condition, with the disappearance of almost all of the symptoms, including the emphysematous bulging above the clavicle. The subsequent history of the case is not given.

The successful catheterization of a bronchus was first reported in 1887 by Landgraf,³⁶ who obtained considerable temporary relief in a case of stenosis of the left bronchus, which was thought at the time to depend upon cicatricial contraction, but which eventually proved to be due to the pressure of an aortic aneurism!

There is no doubt that the trachea and bronchi can acquire a surprising degree of tolerance to such instrumentation. Indeed, in the cases cited the reaction following the frequent passage of bougies was more apparent in the larynx than in the parts below.

Tracheotomy. The record of the performance of this procedure among the cases of tracheo-bronchial syphilis here cited is instructive in that it shows how futile and irrational, in many cases, was the operation, and emphasizes anew the great importance of an accurate diagnosis of both the character and the seat of the lesion.

Tracheotomy was performed seventeen times. In 10 cases (V., VI., XXI., XXIV., XXXII., LII., LX., LXV., LXX., and LXXI.) no good whatever was accomplished by the procedure, the obstruction being situated entirely or in great part below the level of the canula. In three cases (III., XVI., and XXXIV.) slight and temporary relief was noticed, although it was found later that the tube did not reach the point of obstruction.

Two other cases, in which the dyspnæa was due partly to tracheal stenosis and partly to paralysis of the abductors of the larynx, showed considerable improvement which was, however, only temporary.

Finally, in 2 of the 17 cases tracheotomy was of real and permaneut value. In 1 of these (XV.) an-examination with the finger through the wound revealed the stricture some distance below. By means of a long tube this obstruction was passed and the symptoms were relieved. Nincteen months later the patient was alive and was still wearing the

tube. (It would seem in this case as though much good might have been accomplished by gradual dilatation of the stricture through the tracheotomy wound.) In the second case (XLV.) the stricture was situated one-half inch below the larynx and followed gummatous deposit at that point. The dyspnœa was relieved by tracheotomy below, and under large and interrupted doses of potassium iodide the obstruction was so much improved that after six months the tracheotomy tube could be discarded.

The purposes and limitations of tracheotomy should be clearly kept in mind. It cannot be gainsaid that in the past the operation has often been done hastily and ill-advisedly. In tracheo-bronchial syphilis it can serve only one of two purposes: first, to relieve urgent dyspnœa by admitting air to the trachea below the point of obstruction, and, second, to aid in the mechanical treatment of stricture by the introduction of bougies or canulas. Concerning the first use it is evident that this must be limited to lesions of the upper end of the trachea. As a means of furnishing an entrance for instruments for the dilatation of strictures its value is somewhat uncertain. It may be doubted whether a stricture situated at the lower end of the trachea or in a brouchus can be approached any more easily through a tracheotomy wound than through the larynx. In either case the matter is difficult enough and demands the skill of an expert laryngologist. The latter method, moreover, has certain obvious advantages over tracheotomy in the diminished likelihood of a complicating inhalation pneumonia.

The following are the condensed records of 81 cases not hitherto collected, which, with my own case and the 46 tabulated by Vierling, form the basis of this paper:

Case I.—Munk.³¹ Male, aged nineten years. Syphilis one and one-half years before. Cough, purulent expectoration and emaciation for some months. Death. *Autopsy*. Many small ulcers in larynx and throughout all the bronchi.

Evidences of late syphilis. Slight Case II.—Watson. Man.

cough with sudden fatal hemorrhage. Autopsy. Large ulcer in left bronchus perforating branch of bronchial artery.

CASE III.—Gillespie. 38 Man, syphilitic. Sudden suffocative attack. Tracheotomy. Death. Autopsy. Ulcers in trachea and both bronchi. Right bronchus constricted.

CASE IV .- Jones. 39 Man, aged thirty-one years. Cough. Expectoration of fragments of tracheal cartilages. Death two and a half years later. Autopsy. Many scars in lower part of trachea and in both bronchi. Constriction, especially of left bronchus.

Case V.—Charnal. Man, aged thirty-six years. Syphilis twelve years before. Cough and increasing dyspnæa for three months. Labored, stridulous breathing. Suffocative attack. Tracheotomy. Death. Autopsy. Cicatricial stenosis of lower part of trachea. Dilatation of broughi.

Case VI.—Boeckel. Woman, aged fifty-six years. Evidences of late syphilis. Cough. Increasing dyspnæa, with suffocative attacks. Tracheotomy. Death. Autopsy. Cicatricial stricture at bifurcation, involving left bronchus. Old tuberculosis at apices of lungs.

involving left bronchus. Old tuberculosis at apices of lungs.

CASE VII.—Vidal.²⁸ Woman, aged thirty-two years. Syphilis three years before. Cough. Emaciation. Increasing dyspnæa. Stridor. Normal larynx. Voice unchanged. Dull pain behind sternum. Under KI all symptoms disappeared, except stridor on exertion.

Case VIII.—Steiner. 22 Boy, aged twelve years. Inherited syphilis. Cough. Dyspnæa. Emaciation. Stridor. Orthopnæa. Death after several months. Autopsy. Lower half of trachea much constricted by scars. Small polypoid tumor above bifurcation. Right bronchus much stenosed. Enlarged bronchial glands. Perihepatitis.

Case IX.—Lancereaux. Woman. For three weeks hoarse voice, cough, and gradually increasing dyspnea. Orthopnea. Death from erysipelas. Autopsy. Stenosis of lower part of trachea and of left bronchus. Ulceration of trachea and right bronchus. Gummata of

liver.

Case X.—Worms.¹⁹ Woman, aged thirty-four years. Syphilis five years before. For six months a stridulous sound with breathing. Increasing dyspnæa. Cough. Attacks of suffocation. Sudden death. Autopsy. Enormous cicatricial stricture of left bronchus, with disappearance of cartilages. Enlarged bronchial glands.

appearance of cartilages. Enlarged bronchial glands.

CASE XI.—Prengrueber. Girl, aged eighteen years. Chancre nine months before. Increasing dyspnæa. Violent suffocative attacks. Expiration, especially labored, prolonged, and stridulous. Death. Autopsy. Extensive ulceration of trachea with neerosis of cartilages. Valve-like action of detached cartilage causing obstruction during

expiration.

CASE XII.—Morell Mackenzie. Man, aged thirty-nine years. Sudden development of attacks of intense dyspnæa. Well between attacks. Ultimate death. Autopsy. Cicatricial stenosis of lower part of trachea. Lobular pneumonia. Gummata in liver and right kidney.

CASE XIII.—Erichsen. Man, aged thirty-eight years. Syphilis for seventeen years. For three months cough, dysphagia, and dyspnæa, especially at night. Loud stridor. Hoarse voice. Improvement

under anti-syphilitic treatment.

Case XIV.—Zurhelle. Young woman. For several weeks cough and increasing dyspnæa. Whole of visible trachea greatly narrowed. Swollen mucous membrane covered with exudate and showing superficial ulceration. Under KI recovery in six months.

ficial ulceration. Under KI recovery in six months.

CASE XV.—Rey. 55 (First case.) Woman, aged forty-two years.

Evidences of late syphilis. For one month cough and increasing dyspnæa. Suffocative attack. Tracheotomy. Long canula passes stricture. Patient living and wearing canula nineteen months later.

CASE XVI.—Rey. (Second case.) Man, aged forty-three years. Syphilis for ten years. Dyspnæa. Stridor. Suffocative attack. Tracheotomy. Death from pneumonia and empyema. Autopsy. Scars and ulcers throughout larynx and trachea.

CASE XVII.—Rey. (Third case.) Man, aged thirty-nine years. Chancre nine years before. Cough. Increasing dyspnæa. Repeated suffocative attacks. Loud inspiratory stridor. Sudden death. Autopsy.

Stricture of trachea above bifurcation. Ulceration and dilatation above this.

Case XVIII.—Rey.48 (Fourth case.) Girl, aged two and a half years. Mother syphilitic. Symptoms appeared at age of ten months. Cough, hoarse voice, dyspnæa, and intense suffocative attacks. Stridor. No improvement by treatment.

Case XIX.—Ives. 49 Man, aged thirty-five years. Syphilis fourteen years before. For six months cough, increasing dyspnæa, and stridulous breathing. Paralysis of left vocal cord. Gummatous mass seen in upper part of trachea. Complete recovery under mixed treatment.

CASE XX.—Pye-Smith. Man, aged forty-two years. For two years all the symptoms of pulmonary tuberculosis; then cerebral symptoms and death. Autopsy. Both bronchi much contracted and misshapen. Extensive peribronchitis. Interstitial pneumonia. Gen-

eral dilatation of the bronchi. Gumma of dura mater.

Case XXI.—Obtulowicz.⁵¹ Man, aged thirty-two years. ten years before. Increasing dyspnæa. Pain in suprasternal notch. Tracheotomy. No improvement. Sudden death. Autopsy. Annular cicatricial stricture at bifurcation of trachea admitting only a fine sound.

CASE XXII.—Beger.⁵² (First case.) Man, aged thirty-three years. For three months cough, expectoration, dyspnæa, and cyanosis. No stridor. Pneumonia. Death. Autopsy. Some narrowing of trachea above bifurcation and of beginning of both bronchi. Large ulcer in trachea above stricture. Cylindrical dilatation of smaller bronchi. Scar on penis.

CASE XXIII.--Beger.⁵² (Second case.) Man, aged thirty-five years. Syphilis many years before. Symptoms lasted five weeks. Cough, chills, fever, and increasing dyspnæa. Physical signs of intense bronchitis. Death. Autopsy. Small ulcer on posterior wall of upper part of trachea, with perforation of esophagus. Inhalation pneumonia.

Syphilitic lesions in testicles and elsewhere.

CASE XXIV.—Beger. 62 (Third case.) Woman, aged forty-two years. Syphilis for several years. For four months cough and increasing dyspnea. Then stridor, cyanosis, suffocative attacks. Tracheotomy. Death. Autopsy. Old scars in throat. Both main bronchi greatly stenosed by enormous thickening of the walls. Dilatation of trachea above and of bronchi below.

CASE XXV.—Bernays.53 Man. Syphilis ten years before. Some cough and dyspnæa. Sudden death from hemorrhage. Autopsy.

Small ulcer of trachea perforating arch of the aorta.

CASE XXVI.—Oudin.51 Man, aged thirty-five years. Syphilis five years before. Cough. Increasing dyspnæa. Intense stridor. Tracheotomy. Death in six months. Autopsy. Diffuse gummatous swelling of wall of lower end of trachea and of both bronchi, with marked Many small ulcers, with submucous fistulous tracts.

Case XXVII.—Schroetter. Man, aged thirty-two years. Cough, with blood-stained expectoration. Ulcer seen in trachea, which healed under mercurial inunctions. Two months later scar had formed a membranous stricture of extreme grade. This was gradually relieved

by catheterization through the larynx.

Case XXVIII.—Ewart. Woman, aged thirty-eight years. dences of old syphilis. Chronic bronchitis for many years. Died of "pulmonary and renal disease." Autopsy. Evidences of syphilis in liver, spleen, and throat. Extensive scars throughout trachea and both bronchi. Stenosis of orifice of left bronchus. Interstitial pneumonia.

Case XXIX.—Sturge.⁵⁶ Boy, aged two and one-half years. Inherited syphilis. Intense dyspnæa and stridor. Cyanosis. Whispering voice. Sudden death. Autopsy. Extensive ulceration and cicatriza-

tion of larynx. Beginning stenosis of upper part of trachea.

CASE XXX.—MacKenzie.⁵⁷ (First case.) Boy, aged ten years. Inherited syphilis. For several weeks cough, aphonia, and increasing dyspnœa, with suffocative attacks. Loud inspiratory stridor. Inspiratory thrill, greatest over lower part of trachea. Laryngoscope showed ulceration of larynx and redness and bulging of tracheal wall. Almost complete cure under mixed treatment.

CASE XXXI.—MacKenzie. (Second case.) Man, aged forty-five ears. Autopsy. Extensive old sears in middle portion of trachea. Pneumonia of right upper lobe. Old tuberculosis of one apex and of bronchial glands. Syphilitic scars over skin and in pharynx. Peri-

osteal thickening of tibia. Cirrhosis of liver.

CASE XXXII.—MacKenzie. (Third case.) Young man. Syphilis five years before. For eighteen months increasing dyspnea, at first only inspiratory. Paralysis of both abductors of the larynx. Trache-otomy unavailing. Death. Autopsy. Ulcers and gummatous infiltration at lower end of trachea, with marked stenosis. Both recurrent laryngeal nerves involved in a mass of cicatricial tissue and enlarged bronchial glands. Large gumma at apex of lung.

CASE XXXIII.—Gleitsmann.60 Woman, aged thirty-two years. Syphilis for several years. Gradually increasing dyspnæa, with a single suffocative attack. Aphonia. Laryngoscope showed two membranous bands in trachea, opposite fifth or sixth cartilage, forming a sort of

false glottis and causing great stenosis. Cured by KI.

CASE XXXIV. — Jacobson. 61 Woman, aged forty-three years. Evidences of old syphilis in throat. For several weeks increasing dyspnea, with paroxysmal attacks. Stridor. Tracheotomy. porary improvement. Death. Autopsy. Cicatricial stricture of trachea at fourth and fifth rings. Emphysema. Chronic congestion

Case XXXV.—Lancereaux. Man, aged forty-one years. Syphilis fifteen years before. Cough. Dyspnæa. Aphonia. Stridor. Bloodstained sputa. Emaciation. Death. Autopsy. Cicatricial stricture of lower end of trachca and of both bronchi. Stricture of larynx.

Dilatation of bronchi. Syphilis of liver.

Case XXXVI.—Semon. (First case.) Woman, aged forty-six years. Evidences of old syphilis. Pain in throat. Cough. No dyspnœa. Voice normal. Laryngoscope showed large ulcer in upper

part of trachea. Cured by KI.

CASE XXXVII.—Semon. (Second case.) Girl, aged sixteen Severe syphilitic manifestations in throat three years before. Cough, increasing dyspnea and stridor. Laryngoscope showed extensive reddish mass beginning at fourth ring and almost filling lumen. Complete cure in six weeks under mixed treatment.

CASE XXXVIII.—Kopp.⁶¹ (First case.) Man, aged thirty-three years. Syphilis six years before. Cough, fever, chills, emaciation, increasing dyspnea. Loud stridor. Suffocative attacks. Tumor

mass seen near lower end of trachea. Death. Autopsy. Enormous thickening of walls, and stenosis, of lower part of trachea, and of both

bronchi. Dilatation of bronchi. Interstitial pneumonia.

CASE XXXIX.—Kopp. (Second case). Woman, aged sixty-five years. For two years cough, hoarseness, increasing dyspnen, pain in throat, stridor. Tracheotomy. Death. Autopsy. Ulceration of larynx and trachea. Stenosis of trachea and left bronchus by extensive fibrous endotracheitis and peritracheitis.

Case XL.—Schech. (First case.) Man, aged thirty-four years. Chancre fourteen months before. Severe cough, night-sweats, increasing dyspnea, stridor, suffocative attacks. Sputum contained connec-

tive and elastic tissue. Gradual recovery under KI.

Case XLI.—Schech.65 (Second case.) Man, aged thirty-five years. Syphilis eleven years before. For one year cough, increasing dyspnæa, night-sweats, stridor. Laryngoscope showed at the lower end of trachea a nodular, dark red tumefaction, obstructing lumen of trachea and right bronchus. This mass disappeared under KI.

CASE XLII.—Davidson.66 Man, aged thirty years. For five months cough, expectoration, tracheal pain, increasing dyspnæa, stridulous breathing. Death. Autopsy. Large, irregular ulcer at lower end of trachea. Right bronchus much constricted by scar tissue. Evidences

of syphilis in liver, spleen, and testicle.

CASE XLIII.—Ingals.⁶⁷ (First casc.) Man, aged forty-five years.

Syphilis seven years before. Increasing dyspnea, stridulous breathing, paroxysmal cough, tirage, suffocative attacks. Area of dulness to left of sternum. Larynx and upper half of trachea normal. Under large doses of KI marked improvement. Sudden death several months later. Cause unknown.

CASE XLIV.—Ingals.67 (Second case.) Man. Syphilis six years before. For two months violent coughing attacks, severe dyspnæa, stridor, tirage. Stricture located at lower part of trachea by ausculta-

tion. Gradual improvement under the iodides.

Case XLV.—Ingals.61 (Third case.) Man. Hoarseness, cough, and dyspnæa on exertion. Laryngoscope showed several small ulcerating gummata in the trachea oue-half inch below the larynx. Later, the formation of cicatricial bands causing stenosis. Tracheotomy. Under antisyphilitic treatment stricture gradually disappeared. In six months tracheotomy tube could be removed.

CASE XLVI.—Masséi.34 Woman, aged twenty-eight years. History of probable syphilis. For two years dyspnæa and cough. Inspiratory and expiratory stridor. Laryngoscope showed in the trachea at the third ring a diaphragm-like membrane, with an oval opening admitting a No. 12 French catheter. Much improvement by catheteri-

zation.

Case XLVII - Dreschfeld.69 Man, aged thirty-nine years. Symptoms for eight months. Cough, increasing dyspnea, stridor, tirage, cyanosis, orthopnea. Death. Autopsy. Small ulcer in middle part of trachea. Fibrous thickening of tracheal wall as bifurcation, with stenosis of both bronchi. Bronchopneumonia. Syphilis of liver.

Case XLVIII. — Gulliver. 59 Woman, aged thirty-one years. Syphilis seven years before. Died of "bronchitis and pleuropneumonia." Autopsy. Annular stricture of trachea above bifurcation.

Scars of old ulcers in trachea and both bronchi.

Case XLIX.—Schuman-Leclerc. Woman, aged thirty-three years. Died with diagnosis of pulmonary and intestinal tuberculosis. Autopsy. Extensive ulceration and cicatrization in lower part of trachea. Ulcers in both bronchi. Larynx normal. Lobular pneumonia. Gummata of liver. Deforming endarteritis. Amyloid disease of spleen.

Case L.—Turner.ⁿ Man, aged forty years. Destruction of soft palate several months before. Sudden fatal hæmoptysis. *Autopsy*. Large ulcer in trachea just above orifice of right bronchus, with perforation of superior yena caya. Ulceration also of both bronchi.

Case LI.—Bésançon.⁶² Man, aged sixty-two years. Syphilis forty years before. Symptoms chiefly those of emphysema. No stridor. No evidence of stricture. Death of pneumonia. *Autopsy*. Stricture of lower part of trachea. Much narrowing of bronchus to left upper lobe. Scars in liver.

CASE LII.—Gotthelf.⁷³ Woman. Doubtful history of syphilis. For four months cough, expectoration, and increasing dyspnæa. Loud stridor. Tracheotomy. Death. *Autopsy.* Two large ulcers in lower part of trachea. Below these an abscess in wall causing stenosis of trachea and left bronchus. Left bronchus and branches dilated beyond stricture.

CASE LIII.—Gougenheim. Man, aged sixty years. Syphilis twenty years before. Increasing dyspnæa, with loud stridor. Voice clear. Larynx normal. Orthopnæa. Symptoms much improved by

antisyphilitic treatment.

CASE LIV.—Parker. Boy, aged fifteen years. Many signs of inherited syphilis. Increasing dyspnæa. Inspiratory stridor. Clubbing of fingers. Died eventually of acute catarrhal pneumonia. Autopsy. At one and a half inches above bifurcation begins an "obliterating endotracheitis," with enormous thickening of the tracheal wall within the cartilages. Same condition found in large bronchi. Left bronchus almost occluded.

Case LV.—Silcock. 6 Man, aged thirty-two years. Syphilis eight years before. Symptoms for four months. Cough, expectoration, pain between the shoulders, emaciation. One hæmoptysis. Death from pneumonia. Autopsy. Tracheal mucous membrane reddened and infiltrated. Many small ulcers. Ulcers throughout larger bronchi. Bronchi generally somewhat dilated. Pneumonia of right lower lobe. Gummata of liver.

CASE LVI.—Fränkel." (First case.) Woman, aged forty-one years. Hoarseness, cough, emaciation, weakness. Signs of consolidation at left apex. Paralysis of left vocal cord. Death from exhaustion. Autopsy. Many irregular gummata throughout the lower two-thirds of trachea. Scars throughout trachea and both bronchi. Bronchi, bronchial glands, and left recurrent nerve embedded in a mass of dense fibrous tissue—"diffuse indurative peribronchitis."

CASE LVII.—Fränkel." (Second case.) Woman. Symptoms

Case LVII. — Fränkel.ⁿ (Second case.) Woman. Symptoms developed insidiously. Rupture of esophagus in coughing attack. Death from inhalation pneumonia. *Autopsy*. Large area of ulceration in trachea which at one point has perforated the esophagus. Interstitial hepatitis. Amyloid disease of spleen and kidneys.

Case LVIII.—Lucas. Woman, middle aged. Syphilis seven years before. For three months pain and tenderness in upper part of

trachea. Some cough and dyspnæa. Laryngoscope showed rounded, reddish mass on anterior wall of trachea just below larynx and almost

filling lumen. Disappeared under KI.

Case LIX.—Moure. (Mauriac. 19) Woman, aged forty years. For several months increasing dyspnæa, loud inspiratory stridor and cough. Voice normal. Laryngoscope showed tracheal mucous membrane swollen, dark red, and covered with inflammatory exudate. Complete cure in one month by mixed treatment.

Case LX.—Fauvel. (Mauriac. 79) Patient only seen in an attack of suffocation requiring tracheotomy. Intense stridor. Death in a few hours. Autopsy. Large gumma situated astride the point of

bifurcation of trachea and causing great obstruction.

CASE LXI.—Gulliver. Woman, aged thirty-eight years. three months cough, increasing dyspnœa with paroxysmal attacks, stridulous breathing. Death. Autopsy. At lower end of trachea and in both bronchi many irregular, deep ulcers and much scar tissue. Stenosis of trachea and left bronchus. Pneumonia of left lung.

tensive scars in soft palate.

Case LXII.—Sokolowski. (First case.) Boy, aged nineteen years. Cough and gradually increasing dyspnæa for three years. Later, suffocative attacks. Loud stridor. Voice clear. Larynx moves only very slightly on inspiration. Died in suffocative attack after tracheotomy. Autopsy. Diffuse hypertrophic and cicatricial thickening of tracheal wall with diminution of lumen. Inner surface granular, scarred, and ulcerated. Both recurrent nerves embedded in a mass of indurated bronchial glands.

CASE LXIII.—Sokolowski.81 (Second case.) Man, aged fifty-six years. Syphilis twenty-five years before. Cough, gradually increasing dyspnæa, loud stridor. Gradual development of paralysis of both laryngeal abductors. Tracheotomy. Temporary improvement. Later suffocative attack. Death following a second hæmoptysis. No autopsy. Author believes case one of tracheo-bronchial syphilis, with probably

enlarged glands and compression of the recurrent nerves.

CASE LXIV.—Gairdner. Woman, aged thirty-eight years. For several months cough, paroxysmal dyspnæa, blood-stained sputa, inspiratory stridor. Death. Autopsy. Ulcer three and a half inches long in lower part of trachea, perforating wall at one point and extending into both bronchi. Inhalation pneumonia. Gummata of liver. Case LXV.—Landgraf. Man, aged forty-six years. Syphilis for

twenty years. Cough, increasing dyspnœa, suffocative attacks. Tracheotomy. Death. Autopsy. Extensive syphilitic changes in pharynx, epiglottis, and larynx. Ulcers and scars in lower part of trachea and in both bronchi. Purulent peribronchitis. In right bronchus was found a portion of cricoid cartilage which was lacking from larynx.

Case LXVI.—Raymond. (Lécureuil.") Man, aged fifty-four ars. Syphilis eighteen years before. For three mouths cough, emaciation, night-sweats, increasing dyspnæa. Intense inspiratory stridor. Tumor mass on right side of trachea. Death. Autopsy. Dense fibrous and caseous mass partly surrounding and compressing the upper part of trachea. Compression of right recurrent nerve. Syphilomatous nodules throughout trachea. Pneumonia, Gummata of liver.

Case LXVII.—Lancereaux. (Lécureuil.17) Man, aged sixty-two years. Syphilis for forty-two years. Cough, expectoration, dyspnœa,

nocturnal suffocative attacks. Death. Autopsy. Scars and stricture at lower part of trachea. Recent stricture at level of cricoid cartilage.

Stenosis of bronchus to left upper lobe. Bronchopneumonia.

CASE LXVIII.—Mader. Woman, aged fifty-one years. Cough for two years. Increasing dyspnea. Stridulous breathing. Tirage. Pain in suprasternal notch on swallowing. Death. Autopsy. Extensive ulceration in middle portion of trachea. Fibrous stricture of lower end of trachea and of right bronchus. Interstitial pneumonia. Dilatation of bronchi. Syphilis of liver.

CASE LXIX.—Davezac. (Favraud.) Woman, aged seventy-three years. Evidence of old syphilis in nose and throat. Dyspnæa, stridor, tirage, suffocative attacks. Death. Autopsy. Fibrous strictures of

both main bronchi.

Case LXX.—Wright.²⁵ (First case.) Woman, aged thirty-three years. Cough, blood-stained sputa, emaciation, fever, increasing dyspnœa, suffocative attacks. Tracheotomy. Death two and a half months later. Autopsy. Whole of trachea irregularly thickened and Cartilages necrotic. Interstitial pneumonia of left lung. with dilatation of bronchi.

Case LXXI.—Wright.²⁵ (Second case.) Woman, aged forty-five years. For three months cough, and blood-stained sputa. Later dyspnæa and suffocative attacks. Tracheotomy. Death. Autopsy. Trachea ulcerated throughout. Great stenosis two inches below larynx.

Pneumonia.

Case LXXII.—Parrain. (First case.) Woman, aged forty-nine years. Cough, blood-stained sputa, increasing dyspnæa, loud stridor, nocturnal suffocative attacks. Laryngoscope showed larynx normal. In trachea a reddish swelling projecting into lumen from right wall. Cure under mixed treatment.

Case LXXIII.—Parrain. (Second case.) Man, aged thirty-nine years. For four months increasing dyspnæa, intense stridor, tirage. Breathing inaudible over left lung. Larynx normal. No relief from antisyphilitic treatment. Death. Autopsy. At lower end of trachea and in right bronchus the mucosa is congested and softened. Stenosis

of left bronchus from enormous thickening of walls.

Case LXXIV.—Griffin. 87 Woman, aged thirty years. eight years before. For some months tickling in throat and cough. Increasing dyspnæa, with paroxysmal attacks. Laryngoscope showed in upper part of trachea a large, red, irregular, projecting mass covered

with exudate and obstructing lumen. Cured by antisyphilitic treatment.

CASE LXXV.—Kayser. Man, aged twenty-five years. Syphilitic ulceration in throat. Small tumor in neck below larynx. Irregular ulcer seen on anterior wall of trachea. On pressing tumor air and fluid can be seen issuing from tracheal ulcer. Under KI trachcal ulcer healed and tumor diminished in size.

CASE LXXVI.—Seifert. 35 Man, aged forty-three years. year gradually increasing dyspnæa; slow, labored breathing; stridor; Feeble respiratory signs over left chest. Emphysematous ballooning of apex of left lung. Laryngoscope showed larynx normal, slight stenosis of trachea at third cartilage, and marked stenosis just above bifurcation. Physical signs determined stenosis of left bronchus. Both tracheal and bronchial strictures gradually relieved by catheterization.

Case LXXVII.—Nixon.⁵⁹ Man, aged forty years. Evidence of old syphilis. Increasing with symptoms of laryngeal stenosis. Larynx seen to be normal, however. Death. *Autopsy*. Great constriction of lower end of trachea and of both bronchi by gummatous mass sur-

rounding trachea and bronchi.

Case LXXVIII.—Aufrecht.²⁴ Patient showed signs of tracheal obstruction, including absence of the normal tracheal breath sounds heard by stethoscope. Gumma the size of a plum seen just above bifurcation. Under KI symptoms were improving when patient died of pneumonia. Autopsy showed gumma to be almost completely broken down.

Case LXXIX. Duplant. Man, aged sixty-one years. For one year gradually increasing dyspnæa, weakness and cough. Suffocative attacks upon any slight exertion. Tracheal stridor heard by stethoscope. Sudden death. Autopsy. Trachea normal. Extensive change in wall of left bronchus, with marked stenosis. Thickening of the perichondrium, ossification of cartilages, disappearance of muscle and elastic tissue, cicatrization of mucous membrane. Pleurogenous interstitial pneumonia of left lung.

Case LXXX.—Hanzel. Woman, aged forty-eight years. For five

CASE LXXX.—Hanzel. Woman, aged forty-eight years. For five months eough, blood-stained sputa, and increasing dyspnæa. Stridor on exertion. Larynx normal. In trachea just below larynx is seen a rounded, red, tumor mass almost filling lumen. Rapid cure under KI.

rounded, red, tumor mass almost filling lumen. Rapid cure under KI.

CASE LXXXI.—Ovize. Woman, aged thirty-six years. Syphilis nine years before. For six months cough, expectoration, emaciation, and increasing dyspnæa. Slow, labored breathing; stridor; tirage; suffocative attacks. Larynx normal. In trachea is seen a small gumma at level of third cartilage. Slow but marked improvement under mixed treatment.

CASE LXXXII.—Woman, aged thirty years; single and a servant. Admitted to the Hudson Street Hospital on December 3, 1901. Family history good. Aside from an attack of some gastric disturbance one year ago, which lasted for one month, patient says she has always been healthy. She gives no history of rheumatism or syphilis. Admits an

excessive alcoholic habit.

Present illness began only two weeks before admission, when, after exposure, she had a slight chill and began to cough and to suffer from dyspnæa. The cough was accompanied by expectoration of white, tenacious mucus which was at no time blood-stained. Dyspnæa became so marked that the patient was obliged constantly to sit up in bed in order to breathe. There was some pain on coughing. These symptoms had steadily increased in severity.

On admission temperature was 104° F.; respiration, 36; pulse, 120.

Physical Examination. The patient is a woman of medium stature, muscular, and fairly well nourished. She sits upright in bed, with head well forward and anxious, pale face. Skin and mucous membranes are moderately evanotic. No subcutaneous ædema. Voice is

feeble and rather husky.

The respirations are moderately rapid (30 to 36). Inspiration is prolonged, labored, and accompanied by a slight but distinct stridulous sound and by slight sinking-in of the tissues in the supraclavicular and suprasternal regions and of the epigastrium. Expiration is shorter and not labored.

Lungs. Expansion feeble over both chests and apparently equal. Vocal fremitus is unsatisfactory because of the light, feeble voice. Percussion gives everywhere a somewhat hyperresonant note except in the lower part of the left axilla, where the resonance is diminished. Nowhere is an area of well-defined dulness to be found. All the lung borders extend considerably beyond their normal limits.

Auscultation shows the vesicular murmur everywhere feeble, but especially so over the lower lobes, where it is almost entirely masked by sibilant and sonorous rhonchi. A few fine moist râles are heard at both bases posteriorly. Vocal resonance faint and unsatisfactory.

Heart. Apex indistinctly felt in the fifth intercostal space 9 centimetres to the left of the mid-sternal line. The normal area of absolute cardiac dulness is entirely obscured by the voluminous lungs. Heart sounds are faint and clear. Action rapid, regular, and somewhat feeble.

Both liver and spleen are distinctly enlarged, and the free borders of each can be felt a finger's breadth below the costal border. In all

other respects the abdomen seems normal.

The labored inspiration and its slight stridulous sound suggested some laryngeal obstruction, but a careful laryngoscopical examination showed no abnormalities in the larynx, save some slight hyperemia of the cords, nor could any obstruction be seen in the trachea.

The larynx moved only slightly with respiration. The head was not retracted. No struma or enlarged glands could be detected in the

neck. The urine contained a trace of albumin.

During the next three days the condition of the patient showed little change. The dyspnoa and cough rather increased in severity, while the temperature fell to about 101° F. and remained there.

The symptoms were so suggestive of stenosis of the larger air passages that the chest was repeatedly examined for evidences of aneurismal

or other growth which might explain the symptoms.

On December 7th, four days after admission, there were two paroxysmal attacks of suffocation. In the second of these the pulse failed rapidly, the temperature became subnormal, and the patient died.

Autopsy. (Dr. Biggs. Condensed report.) Chest. Pleuræ show a

few old adhesions on both sides. No fluid. Pericardium normal.

Heart of normal size. Cavities partly distended with fluid blood. Valves competent. Muscle of fairly normal color and consistence.

Coronary arteries show a few small areas of arterio-sclerosis.

Lungs. Left. Lung tissue shows everywhere a condition of marked emphysema. The small bronchi contain mucopurulent secretion. A portion of the anterior half of the lower lobe is consolidated, of reddish color, and has the appearance of an area of lobar pneumonia. Right. This shows the same condition of emphysema. A considerable portion of the middle lobe is in the condition of gray hepatization. In the central part of the upper lobe is a small area of beginning consolidation.

Larynx normal.

Trachea and Bronchi. Slight uniform thickening of tracheal wall everywhere. More marked at lower end, where wall measures 4 mm. in thickness. At a point 8 mm. below bifurcation the *left* bronchial wall becomes greatly thickened, with such encroachment upon the lumen that this measures only 2.5 mm. across. This thickening of the

bronchial wall involves the entire circumference of the bronchus and extends downward for a distance of 1 cm., where the wall resumes its normal thickness and the lumen widens out into a cylindrical dilatation of 13 mm. diameter. On section through the thicknesd wall no cartilage can be seen, and the wall has a thickness of from 1 mm. to 8 mm., the tissue being, apparently, entirely dense fibrous tissue.

In the right bronchus just below its first division there is a similar stricture, 1 cm. long and from 3 mm. to 4 mm. in diameter, involving the branch to the lower and middle lobes. The wall here is 5 mm. to 6 mm. thick. This stricture on section shows the same absence of cartilaginous rings and accumulation of fibrous tissue as does that of

the left bronchus.

The wall of the right bronchus shows some general thickening (3 mm. to 4 mm.) in addition to that producing the stricture. The bronchus is not dilated beyond the point of stenosis.

Spleen. This is about one and a half times its normal size and is very firm. On section it shows the typical "sago" bodies, and with

Lugol's solution quite extensive amyloid degeneration is seen.

The liver and kidneys also show a moderate degree of amyloid degeneration, but in other respects show little departure from the normal.

In none of the other abdominal viscera were lesions of importance

to be found.

Aorta. Throughout the whole of the aorta and the larger arteries generally the intima is thickly studded with nodular plaques of arteriosclerosis, some of which show atheromatous degeneration and calcification.

Microscopic Examination. (Conner.) Sections of the thickened and strictured portions of the two bronchi show practically identical lesions. The normal bronchial wall is entirely replaced by fibrous tissue, in which no trace remains of either muscle or elastic tissue. The mucous glands have disappeared, and of the cartilaginous rings nothing remains but a few small fragments of rarefied cartilage situated in the centre of the fibrous mass. The columnar epithelium is replaced by a number of layers of cuboidal and flattened cells which approach as they near the surface the type of pavement epithelium.

At the periphery of the wall are to be seen small lymph nodes infiltrated with fibrous tissue and closely adherent to the fibrous mass. The fibrous tissue is dense and old and shows scattered through it are many small areas of round-cell infiltration and a few thick-walled

bloodvessels.

Elsewhere throughout the bronchi and trachea the moderate thickening of the walls seems to be due to an increase in the fibrous layer enclosing the cartilages and in the submucous coat.

The nature of the bronchial lesions themselves, the amyloid degeneration of the liver, spleen, and kidneys, and the extensive arteriosclerosis (at the age of thirty years), seemed to leave no doubt that the strictures were of syphilitic origin, although no definite syphilitic history had been obtained from the patient.

The character and distribution of the bronchial lesions may be indicated, perhaps, by the cumbersome name of diffuse indurative peribronchitis and endobronchitis. As to the manner of origin of the condition only surmises can be made. It apparently did not arise from

the cicatrization of an ulcer of the mucosa. Whether it resulted from the formation of gummata in the bronchial wall, or in the bronchial lymph glands (as Lécureuil¹¹ has suggested), or whether, from the beginning, it was a diffuse productive inflammation of the wall, without gummatous deposit, must remain uncertain.

During the four days in which the patient was under observation no satisfactory diagnosis could be reached. The inspiratory type of dyspnea, the faint stridor, and the inspiratory sinking-in of the neck and epigastrium, suggested some obstruction in the larger air passages. This was clearly, however, neither in the larynx nor in the cervical portion of the trachea. The physical signs of the thorax, also, failed to give any clue to the cause of the dyspnea. Neither in the lungs nor in the mediastinum could any definite lesions, other than those of emphysema and bronchitis, be demonstrated.

In spite of the absence of all signs of thoracic aneurism that condition seemed to be, perhaps, the one most likely to be the source of the

difficulty.

The fact that two considerable areas of pneumonic consolidation should have been altogether overlooked in the frequent physical examinations, was the source of surprise and mortification at the necropsy, until the lesions of the bronchi were discovered; then the absence of bronchial breathing was at once explained by the presence of the strictures.

Although the dyspnœa was quite severe throughout, the patient's condition was not regarded as grave until the appearance, on the last day, of the two suffocative attacks. Then, however, the dyspnæa became intense, the cyanosis grew more pronounced, and the heart failed rapidly.

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THE PROMINENCE OF THE EYEBALL AND A METHOD FOR MEASURING IT.

By Edward Jackson, M.D., of denver, col.

THE need of a simple practical method for measuring the prominence of the eyeball has doubtless been felt by many observers. The difficulties of estimating accurately the degree of exophthalmos, or enophthalmos, from Graves' disease, tumors, inflammatory swelling, and injuries to the orbit, or high myopia or hyperopia, have usually prevented an exactness in the reports of such cases that would be quite desirable. The lack of exact measurements also causes uncertainty regarding the progress of any given case.

Certain measurements of the orbit have been carefully made in the laboratory, and in the pursuit of various lines of scientific investigation. An elaborate instrument for measuring the prominence of the eye, suitable for laboratory studies, has been devised by Birch-Hirschfeld; but we have had no fairly accurate and readily applicable method of determining the prominence of the eyeball suited to general clinical use. To meet this want I have worked out the following plan, which has for over three years served me in a very satisfactory manner.

The point best suited for a reference point, in this connection, is the point in which a plane, passed through the visual axes of the eyes when these are in the primary position, intersects the outer margin of the orbit. This point is very nearly the most retreating portion of the outer margin of the orbit, and is easily determined with sufficient accuracy upon the normal face or upon the denuded bone. Hence it serves as a common point of reference for measurements made upon the living head and those upon the bare skull. Many measurements have shown that this part of the orbital margin has the least variable relation to the apex of the orbit, and to the more important landmarks of the skull. This point has a comparatively thin covering, which varies in thickness but little in different persons and in different con-

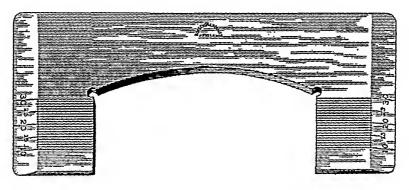
¹ Read before the College of Physicians of Philadelphia, June, 1902.

² Klinische Monatsblätter für Augenheilkunde, November, 1900.

ditions of embonpoint. The line joining these corresponding points of the two orbital margins constitutes a base line from which the prominence of the eyeball is to be measured.

To measure such prominence the rule shown in the illustration is employed. The curved side of the rule is pressed against the face, the straight edges resting on the outer margins of the orbits, so that the upper surface of the rule (the one shown in the figure) shall be just in the plane of the visual axes, the eyes being directed horizontally toward the distant object and the head held erect.

There are parallel lines on the upper surface of the rule. The observer places his eye to the right or left of the patient, according as he wishes to determine the prominence of the right or left eye. He then sights along the parallel lines and notices between which of these lines the most prominent part of the cornea appears to fall. The lines are ruled 1 mm. apart, and serve to indicate within 0.5 mm. the protrusion of the cornea beyond the line of reference—a degree of accuracy sufficient for all practical purposes.



Such an instrument, for measuring the forward projection of the eyeball, may be called a *protometer*. This name, suggested by my friend Dr. T. B. Schneideman, has an obvious relation to proptosis, which has come to be used chiefly in connection with the eye.

In making such measurements care should be taken to have the eyes turned pretty directly forward. A little deviation to the right or left will make but little difference in the result obtained; but a decided departure from the median direction will cause the eye to appear less prominent, because the centre of rotation is posterior to the centre of the anteroposterior axis of the eyeball, and because the diameter of the eyeball passing through the sclerocorneal junction is shorter than the anteroposterior diameter.

To provide for different widths of the face I have used two of these scales in question, one 96 mm. and the other 86 mm. in width between the two parts of the straight edge to be pressed against the orbital margin. For very young children a still narrower one might be used; but for the great majority of adults a gap of 90 mm. in the straight edge is sufficient and answers the purpose. A rule of this kind can be quickly made from a piece of thin wood or cardboard. It has been neatly constructed of wood by Bonschur & Holmes, of Philadelphia.

In the great mass of cases the distance of the summit of the cornea in front of the reference line is between 12 and 20 mm., averaging about 16.5 mm. Often there is a difference of 0.5 mm. in the prominence of the two normal eyes. But rarely the difference amounts to 1 mm. unless due to disease, as excessive myopia of the more prominent eye, or orbital changes causing exophthalmos or enophthalmos. The averages indicate that the eye becomes a little more prominent up to the age of sixteen or eighteen years, and that there is a very little sinking in old age; but these changes, and those produced by wasting disease, are probably very much less than might be supposed from casual inspection of the appearance of the orbit. My intention, however, is to discuss these variations of both normal and abnormal eyes at some future time. The present purpose is to put before the profession this simple aid to exact diagnosis.

LOCALIZATION OF FOREIGN BODIES IN THE EYE AND THEIR REMOVAL:

WITH REPORT OF CASES.

BY LOUIS C. DEANE, M.D., SURGEON TO THE CALIFORNIA EYE AND EAR HOSPITAL, SAN FRANCISCO, CAL.

LOCALIZATION of foreign bodies in and about the orbit has received a great impetus since the advent of X-ray diagnosis.

Formerly, if by any chance a foreign body, such as a piece of steel, iron, lead, shot, glass, porcelain, or coal, had penetrated into the paraocular tissues we were satisfied to know whether it was intra-ocular or extra-ocular, and whether, if it were a bullet, it had penetrated into the cerebral cavity. Occasionally we were able to locate it with the ophthalmoscope before the media had lost their transparency through hemorrhage, traumatic cataract, or inflammatory exudation.

If it could not be seen, one of three things had to be done: first, to thrust a magnet blindly into the vitreous, if there were reasons for believing it to be iron or steel; second, to remove the cyc, if the inflammatory reaction were profound, or, if not, third, to allow the cyc to remain, with the possible danger of sympathetic ophthalmia or in the loope that the foreign body might not be in the globe at all.

The sideroscope (a sensitive magnet hung on a strand of silk, which is deflected when brought near a piece of steel or iron) has a limited value in showing the presence of such a foreign body in the globe or orbital cavity.

The giant magnet of Haab, when brought within the distance of an inch of a piece of steel or iron, lodged in the eye, exerts a marked attractive force often sufficient to draw such a body to the front of the globe if it is not held by inflammatory adhesions or embedded in tissue, where it can be seen and extracted.

These methods of procedure, while they have their value, are often vague and uncertain, and I am convinced that frequently much unnecessary damage is done by the magnet where the exact location of an object is not known. Of course, these instruments are useless in the presence of lead, porcelain, glass, coal, etc.

An X-ray photograph of a foreign body lodged in the orbital region, when taken without the aid of a localizer, is most confusing if an effort is made to determine its position. It is for this reason that numerous attempts have been made to devise exact methods and instruments of precision for the determination of their exact location.

One method might be mentioned, that of Webster Fox, who places an oval band of gold, divided so as to correspond to the principal quadrants of the eye beneath the lid, its shadow acting as the localizer. Two skiagraphs are necessary, one a temporal and the other an occipitofrontal view.

I have tried this method, but must say that in my hands it was of little value. The same cases were subsequently localized by the method described in this article, and the decided and exact character of the results left no doubt in my mind as to its superiority.

The localizer here shown was constructed after the pattern of a machine used by Makenzie Davidson, of London, with the exception of some modifications to enlarge and render more accurate its field of usefulness. Its object is to determine the exact position of foreign bodies in the head with special reference to those lodged in the orbit and eyeball.

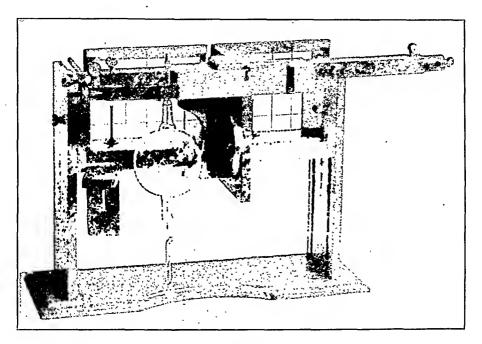
The great importance at times of calculating the exact position of a piece of steel, shot, or bullet, which has penetrated the orbital or cerebral cavity, and the difficulty, or I might say impossibility, of determining its exact location without the aid of a localizer similar to the one I present, prompts me to demonstrate the method whereby these results are arrived at, also to review a few characteristic cases with photographs and projections.

The method of taking two separate radiographs of an object held immovable, from two different points of view and calculating the relative displacement of each in regard to certain fixed markings, to determine its distance from the plate, is not a new one.

This localizer is so constructed that it gives us exact figures to work upon, so that it is possible by the simplest methods of triangulation to arrive at exact conclusions.

The localizer consists of a framework supporting two cross wires at right angles to each other, and has a mechanism to hold a Crooke's tube in a certain position so that the luminous point of rays emanating from the anode is perpendicular to both. The head is then clasped in the machine and held immovable after proper localizers are placed on

FIG. 1.

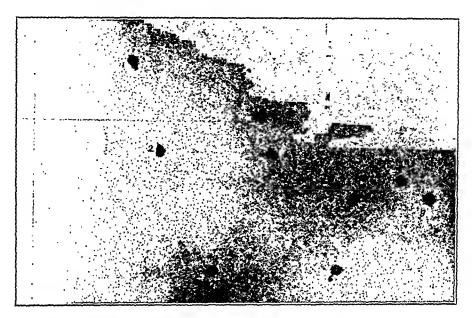


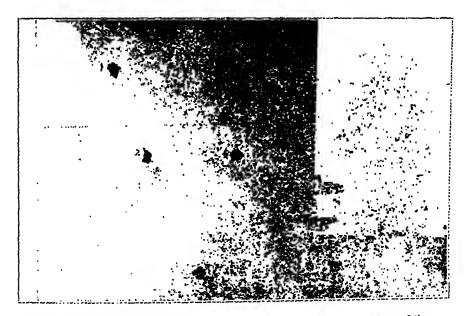
The localizer.

the face to determine the median line of the head, the vertical meridian of the eye, and the lower limbus of the cornea. The tube is then withdrawn on a line parallel with the horizontal wire a known distance and a radiograph taken. Without removing the head the tube is replaced in its original position and again withdrawn the same distance in the opposite direction, and another radiograph is taken.

We have now two radiographs with the same object shown on different parts of the plates, the distance between them and their relation to the cross-wires can now be easily determined. The distance of the luminous point on the anode from the plate and the displacement each way from the perpendicular are also known. The distance of the opaque markers, placed upon the face, from the plate has already been measured to verify our results later. With this data at hand one may arrive at conclusions so accurate that the location of the foreign body

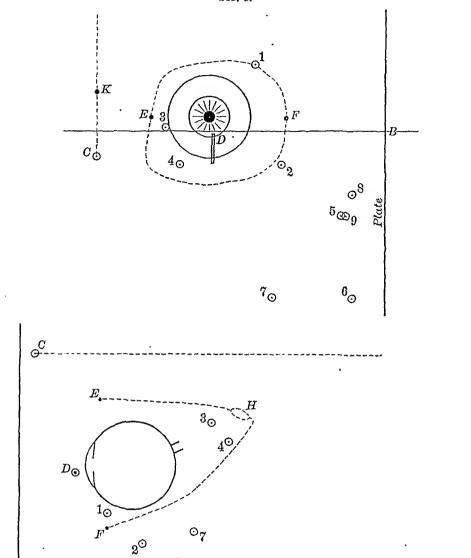
FIG. 2.





Case I. X-ray photographs (reduced in size) showing nine shot. The positions of the same shot in their relation to the cross-wires are shown in the two photographs. Their exact location in two planes is seen in Fig. 3.

can be determined within one millimetre. This localizer has a wider range of usefulness than the older instruments in that two-sized plates



Left Eye

Plate

80

Case I. Vertical and horizontal projections slightly reduced in size from the normal, showing the exact location of the nime shot. C. Lower end of nasal bones, which also marks the median line, corresponding to the nasal septum, vomer, perpendicular plate of the ethmoid, centre of optic commissure, etc. D. Wire placed on lower lid one millimetre to outer side of vertical meridian of the globe, the upper end of which corresponds with the lower limbus of the cornea. Shot 1, resting on the bone at upper and outer margin of the orbit. Shot 2, on the outer surface of the malar bone. Shot 3, near the apex of the orbit, resting below and to the inner side of the optic nerve, 13 mm. behind the globe. Shot 4, near the apex of the orbit lying below the optic nerve and 16 mm. posterior to the globe. Shots 5, 6, 8, and 9 are superficial, lying beneath the skin in the region of the car. 5, 8, and 9 are about on a level with the auditory meatus, 5 in front and 8 and 9 immediately behind. No. 6 is near the tip of the mastoid, embedded in the attachment of the sternocleidomastoid muscle. Shot 7 is embedded in the masseter muscle over the ramus of the jaw. The actual distance of the various shots from the wire may be determined by a little descriptive geometry—1.36 mm., 2.23½ mm., 3.62½ mm., 4.57 mm., 5.13 mm., 6 9 mm., 7.32 mm., 8.8 mm., 9.11 mm. D, tip of the wire, 49 mm., C, point at lower end of nasal bones, 82 mm. Eand F were determined by actual measurement upon the face; E was placed 18 mm. posterior and 13 mm. to the outer side of C (the lower ends of the nasal bones). The width of the orbit on a level with the horizontal meridian of the globe is 37 mm., and so F was fixed. The distance from E to the apex of the orbit was taken as 43 mm taken as 43 mm

can be used, so that a foreign body can be located in any part of the head instead of the immediate region of the orbit.

Case I.—(Figs. 2 and 3.) Robert B., aged eight years, was shot from a distance of seventy feet on February 30, 1901. Case referred by Dr. Overacker. The gun was loaded with No. 7 shot. The shot passed through the skin of the left arm and the left side of the head. The lower lid was penetrated with two shot which entered the globe through the sclera at places corresponding to the wounds in the lid, one at the lower, inner, and anterior quadrant, and the other at the lower, outer, and anterior quadrant of the globe.

I saw the boy for the first time eleven days after the accident. L. V. perception of light only. Tension minus. The ocular conjunctiva was congested without signs of inflammation. Cornea and aqueous Iris discolored, due to blood. The iris showed no signs of inflammation and dilated readily to atropine, none having been used previously. Lens and anterior capsule normal in appearance. With the ophthalmoscope there was no red reflex because of an extensive hemorrhage in the vitreous. The patient had suffered no pain, and there was no pain on pressure.

This case seemed to present some features of special interest. shot evidently carried no infection with them, as not the slightest trace of inflammatory reaction could be noticed. The signs of their passage into the globe were conclusive, and if they passed out again the removal of the eye was not warranted. If the shot were in the globe the dangers of sympathetic ophthalmia would be greatly increased, and it would be well to consider its enucleation.

By the aid of the localizer I was enabled to show that the two shot. Nos. 3 and 4, had passed through the globe and were lodged in the orbital cavity (Fig. 3), so the eye was left intact and the patient assured that no danger was to be anticipated to the other eye. Had I been in doubt as to their location I would certainly have been justified in enucleating the eye.

Case II.—J. S., aged thirty years, Spanish, referred by Dr. Payne, was shot full in the face with No. 7 bird-shot from a distance of about three hundred feet. The right eye showed that one of the shot penetrated the upper half of the cornea. There was a traumatic cataract with a part of the lens mass in the anterior chamber, and the iris prolapsed and incarcerated in the wound. There was a good deal of conjunctival edema and a marked orbital cellulitis, with considerable pain. He could see moving objects on the temporal side.

The left eye showed slight orbital cellulitis. Anterior segment of the eye and lens uninjured, but impossible to get any view of the fundus. Absolutely no light perception. Eye tender, but no pain. Both eyes gradually became softer and passed on to phthisis bulbi.

This case presents no special features, because both eyes were destroyed, but it demonstrated the location of a shot in the right eye, exactly midway between the horizontal and vertical meridians in the lower and inner quadrant, 2 mm. anterior to the equator and resting upon the retina.

Case III.—(Figs. 4 and 5.) Mr. L., two months ago, while hammering a pipe above his head, felt a sharp shock to his left eye, followed by pain for an hour. He bandaged his eye and continued working with no further inconvenience than sensitiveness to light when he removed the bandage. After four days the bandage was removed. The eye was blind, due to the rapid development of a traumatic cataract.

The case was referred to me by Dr. Payne for localization of a piece

of steel or iron lodged somewhere in the globe.

The appearance of the eye at this time showed that a foreign body had passed through the cornea, iris, and lens. The anterior chamber had been evacuated, as there was an attachment between the corneal wound and iris, forming an anterior synechia. This had pulled the anterior layers of the iris forward, leaving the pigment layer adhesive to the anterior capsule of the lens, which was very misleading, giving the impression that it formed part of the foreign body lodged in the iris.

This case had already been placed before the giant magnet, and, while some pain was felt at the time, there was no real evidence that a piece of steel or iron was lodged there, and that method of extraction was abandoned.

The position of the piece of iron was determined by the localizer to be resting on the floor of the eyeball on a line with the vertical meridian and three and a half millimetres posterior to the equator.

An incision through the sclera was made in the immediate region of the point indicated in the diagram, and the foreign body extracted by the magnet, with a small piece of choroid in which it was evidently embedded.

I will say for the localizer that without its use I am certain that by no other method could this foreign body have been extracted.

Case IV.—R. McL., aged thirteen years. Referred by Dr. Mays. Five weeks ago the boy was shot in the face with a load of bird-shot at a distance of forty-five feet. Many shot embedded themselves in his face. One passed through the upper lid and penetrated the cye through the upper ciliary region, evacuating the anterior chamber and prolapsing the iris, which was excised later. A severe uveitis was the result, the vitreous being entirely opaque. The lens, queer to say, is transparent, no traumatic cataract having formed.

The eye is now sensitive, with pericorneal injection, postcrior synchia. The patient is suffering from an orbital cellulitis with fever,

which has confined him to his bed.

After localization, certain facts were elucidated. The shot that struck the upper lid is apparently not the one that passed through the globe. There are two shot in the orbit. The one that entered the globe passed out again and is lodged six millimetres posterior to it and rests upon the optic nerve. The one that passed through the upper

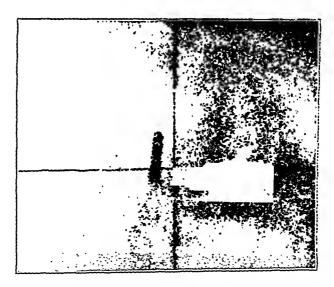
lid is in the upper part of the orbital cavity on a line vertical to the

posterior pole.

Nine shot in all were located. The two shot in the orbital cavity had, no doubt, carried in the infection and were causing the cellulitis.

FIG. 4.





Case III. Shows the presence of a chip of iron lodged in the eye. Note Fig. 5.

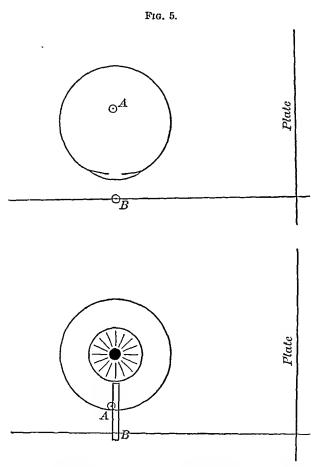
Case V.—(Figs. 6 and 7.) P. D., aged forty years, miner. Referred by Dr. Pischel. Four years ago a piece of steel flew in the left eye, but later the patient picked up a piece of steel about as large as a pea on the floor. He could not see for two weeks, then good sight returned. A year later sight became dim again.

Two years ago a cataract was removed, and severe inflammatory re-

action followed. After the operation, until three weeks ago, he could

see outlines of figures.

At present there is no perception of light. Cornea appears dim from fine, brown exudate on posterior surface. In the upper quadrant of the eornea half a millimetre from the limbus is a horizontal sear, to which the iris is drawn, so that the pupil appears vertically Anterior chamber deep, iris trembling, and tension high. Fundus eannot be seen elearly enough to distinguish an exeavation of the disk. Eserine lowers tension.



Case III. Horizontal and vertical projections showing location of chip of iron, A, as described in text.

The giant magnet eaused considerable pain, indicating the presence

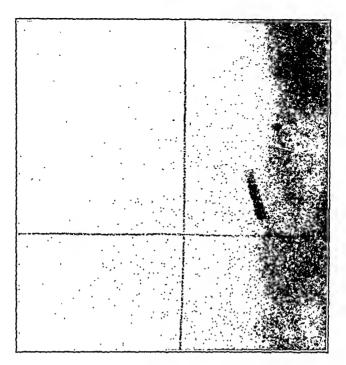
of iron or steel in the eye, though it could not be dislodged.

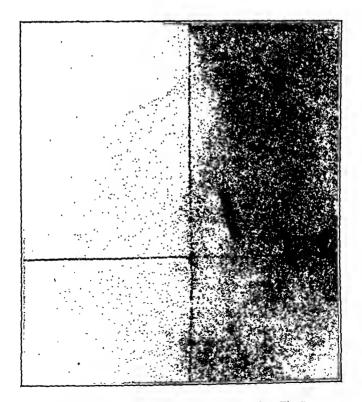
After localization the foreign body was seen to be two and a half millimetres above the horizontal meridian, and five millimetres to the inner side and posterior to the limbus, resting upon the retina in the region of the ora serrata. An incision was made directly over this spot and the chip of steel removed by the magnet.

CASE VI.—(Fig. 8.) Referred by Dr. Brady. Seven months ago,

while shoeing a horse, the patient's hammer missed the nail and struck the shoe, so that a splinter from the hammer struck him in the left eye.

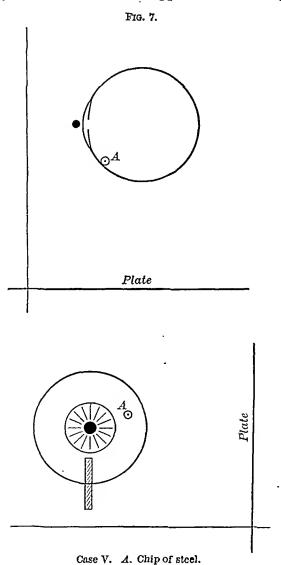
Fig. 6.





Case V. Chip of steel lodged in the eye. Note Fig. 7.

Dr. Brady saw him four hours later, when there were no inflammatory symptoms. At the middle of the inferior quadrant of the cornea, two millimetres from the limbus, was a linear perforation, and immediately behind it was a similar wound in the iris, about two millimetres long. Through the latter was seen the red fundus reflex and the margin of the uninjured lens. The fundus was normal, and the ophthalmoscope and oblique illumination failed to reveal a foreign body. The eye was several times approached to the giant magnet,



with negative results. As there was no reliable X-ray apparatus available at the time, Dr. Brady adopted palliative and antiphlogistic measures. Vision was 20/30. A few days later there was a mild iridocyclitis. The iritic congestion was depleted by instilling two drops of adrenalin chloride, 1:10,000, every two hours. Vision was now 20/200.

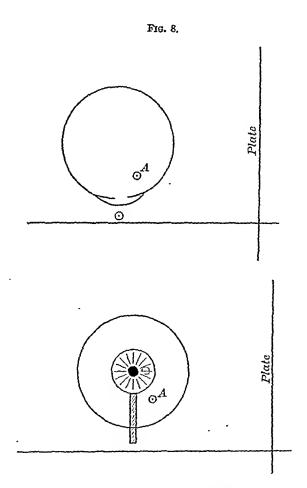
Having seen eyes enucleated and the foreign body found after failure with the magnet, Dr. Brady kept the case under observation.

For his own satisfaction and the patient's security he referred the case for localization, which showed a small foreign body, less than a millimetre in diameter, just behind the ciliary region and about the middle of the lower and inner quadrant.

The vision is now 20/50 plus, and the body being well tolerated, it

was thought best to leave it undisturbed.

Case VII.—(Figs. 9 and 10:) J. H., aged forty-nine years, black-smith. Injured on May 10, 1902, and referred by Dr. Schloss. Was hammering one sledge upon another when something struck his right eye. Five days afterward there was marked chemosis, no iritis, lens



Case VI. Horizontal and vertical planes. A. Location of chip of steel.

opaque, no increase of tension. At first there was pain in the globe, which subsided before atropine had been used.

A piece of steel four by two millimetres was located two millimetres below the horizontal meridian and nine millimetres posterior and to the outer side of the limbus, resting lightly on the retina.

An incision through the sclera was made immediately over the part indicated in the diagram, and a large piece of steel extracted by the magnet, which verified both our calculations as to its size and position. Résumé of Cases Showing Some of the Advantages of the Localizer. In Case I. nine shot were localized, but none in the globe, which showed two scleral wounds and a dense hemorrhage of the vitreous. The two shot that entered the globe passed out again. This dispelled the doubt as to their position and avoided possibly a subsequent enucleation.

Case II. shows how a great number of shot can be located on the same radiograph, and proves its accuracy, as the eye was removed and the shot in the globe was shown to be exactly as indicated in the diagram.

Case III. is of interest in that the giant magnet had been used without giving any positive evidence of the presence of a piece of steel, possibly because it was firmly embedded in the choroid and surrounded by organized inflammatory exudate.

An incision was made directly over the foreign body, with no other indication than the diagram, and by the aid of the giant magnet a piece of steel was removed through the sclera with a small mass of choroid and organized exudate.

Case IV. shows the location of nine shot and the undoubted cause of a severe orbital cellulitis.

Case V. A scleral wound was made directly over the foreign body, as shown in the diagram, and a piece of steel extracted.

The giant magnet was used without success, which shows its inability to dislodge a piece of metal when embedded in tissue, as in Case III.

Case VI. is only included among these cases because it demonstrates that very small pieces of metal, less than a millimetre in diameter, show themselves in the radiograph.

Case VII. is where a large piece of steel, four millimetres long by two millimetres broad, was removed by the magnet through a scleral wound.

The giant magnet was not previously used upon this case because it was deemed safer to extract it directly through the selera than drag it through the vitreous, back into the ciliary region, possibly entangling it in the iris.

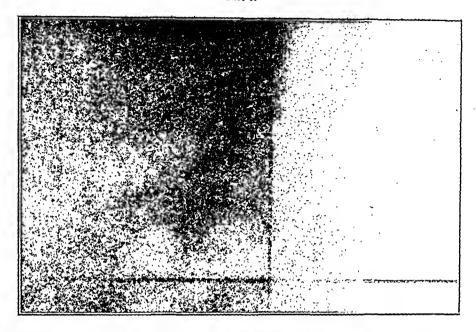
I do not wish to disparage the use of the giant magnet, for in many cases it has made such work possible, proving itself a most useful adjunct to the localizer.

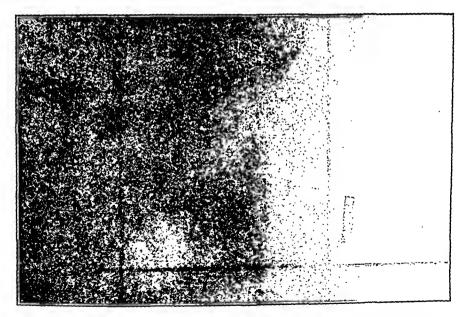
It must certainly be apparent that if there is any doubt as to the location of the piece of metal, which must be the rule, the localizer should first be resorted to, thereby gaining valuable information, in many cases avoiding a considerable amount of unnecessary traumatism, and greatly simplifying its extraction.

The number of cases where the foreign substance can be seen are very few. Haab reports that in 165 cases 80 had traumatic cataract,

and, with hemorrhage and inflammatory exudation, it places this class of cases greatly in the minimum,

Fig. 9.





Case VII. The photographs show a piece of steel 4 mm. by 2 mm. in the orbital region.

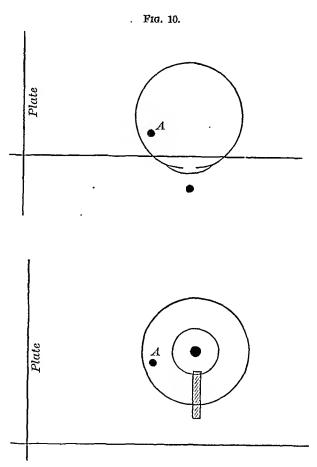
For its location, note Fig. 10 and the text.

To show how easily one can be deceived by appearances, in Case III. a bit of iris pigment could not be distinguished from a piece of

iron by the closest observation. The localizer proved it to be pigment and showed a piece of metal in another place from where it was subsequently removed through a scleral wound, made directly over its location.

Some objection has been offered to removing foreign bodies through scleral wounds on account of the danger of detachment of the retina.

As to my own experience, in the past two years, with scleral wounds, I am pleased with the simplicity of this method, and in 14 cases thus treated I have not observed a subsequent detachment.



Case VII. A. Piece of steel. For a description of its location, note the text.

I have seen one case, previous to the present method of extraction, where a detachment of the retina followed the usual extraction of a piece of steel by the Haab magnet. The magnet was not used for three weeks after the injury, and, I believe, in drawing the steel forward it detached the retina to which it was adherent.

I am pleased to see that there are some who concur with me (Sweet, Holt, etc.) in the advisability of scleral extractions where the position

of the foreign substance is known and near or posterior to the ora

It must be said of many advocates of the giant magnet that they begin their work of extraction without exact knowledge of the position or size of the substance they are about to remove. To these the scleral wound is only a return to the old method of opening the sclera and inserting the tip of a small magnet blindly into the vitreous. With the localizer and giant magnet the latter need never be done, and there can be no question that much damage is thus avoided.

THE LYMPHATIC SYSTEM AND THE TONSILS.1

BY HENRY L. SWAIN, M.D., OF NEW HAVEN, CONN.,

PROFESSOR OF DISEASES OF THE EAR AND THROAT, YALE UNIVERSITY; FELLOW OF THE AMERICAN LARYNGOLOGICAL ASSOCIATION, ETC.

PERMIT me in presenting to your attention this evening this subject, with its rather uninviting title, to adopt the methods of our brethren who dispense the consolations of religion, and to take the history of a case as a text or point of departure, suggesting the lines of thought which will be followed in these remarks. The case is in itself rare enough to excite our interest, and demonstrates the reverse picture of what we have clinically long observed, viz., the influence of the tonsils on the general lymphatic system.

Mr. P., aged sixty-three years, consulted me in June, 1899, with the statement that he had had a bad throat for the last six months, having felt that he was having a gradual filling up of the throat without pain or soreness. He had had no violent cold or fever. His throat sometimes felt so full that he could scarcely swallow, and he often expe-

rienced difficulty in breathing, especially on lying down.

Examination of the physical condition developed that he was a fairly well-nourished man of his age, and apparently possessed a fair amount of physical vigor. There was no evidence in the general physical examination of anything, except what was referable to his throat, other than a complete alopecia, for which he wore a wig. The outside of his neck appeared to be somewhat thicker than seemed reasonable in a man of his general build, and the lymphatic nodes in the neck back of the angle of the jaw were diffusely but not greatly enlarged. Otherwise the glands of the body were palpable, but not increased in size. In the erect position he was able to breathe fairly well through his nose, or as easily through his nose as he did with his mouth open. Examination of the throat developed the condition which is evident in the drawing which I will pass around. Both faucial

¹ Read before the Section on Otology and Laryngology of the College of Physicians of Philadelphia, March 18, 1903.

tonsils were enormously enlarged, the increase in size being not merely toward the median line where they met, but in every direction, being circumferentially very much increased. The lingual tonsil, as is seen in the picture, was as much enlarged as I have ever observed, and seemed to not only project upward so as to be readily seen by direct examination, but also downward and backward sufficiently to depress the epiglottis, making it impossible to see the interior of the larynx. All this tonsillar tissue presented an absolutely pale surface. There was not the slightest trace of inflammation or other abnormality in appearance except the size and the pallor. Evidently we had to do with a perfectly simple hypertrophy. There could not be in the physical appearance a shadow of mistrust of anything in the way of tumor growth. Careful inquiry failed to develop that the patient had the slightest pain in any way whatsoever from this enormous mass, and he merely was annoyed because of the sense of fulness and the difficulty in swallowing and occasionally in breathing.

I immediately felt that we had here to do with a constitutional disease which was expressing itself in the tonsils, and to that end had an examination made of the blood, and for treatment started the patient upon the simplest of gargles and physiological doses of Fowler's solu-

tion.

In five days the tonsils had gone down considerably both in appearance and as far as the speech and comfort of the patient went. In five days more he could swallow with but little difficulty, and felt very much relieved. The examination of his blood had developed a moderate increase in the white blood cells present, a normal number of red blood cells, and a slightly diminished amount of hæmoglobin. Among the white blood cells there was proportionately a larger number of the small mononuclear type than one commonly sees. The eosinophilous cells were rather diminished in number. The polymorphonuclear cells were slightly if at all increased. The patient then disappeared; did not take his treatment, because the Fowler solution had begun to interfere with his comfort and digestion, and I saw no more of him for two months, when he came back with the condition of his throat even worse than on his first examination, and this in spite of having for two weeks taken Fowler's solution on his own He had, in fact, taken it in such large doses as to have again upset his digestion, and had failed to receive the relief which he had found so marked on his first visits. I then saw him at frequent intervals, at which I would spray him out thoroughly with extract of the suprarenal glands, and gave him some to use at home as a gargle. I had another blood count, and found that the blood conditions were similar to those of the previous examination. In a week of moderate dosage with arsenic and local treatment he had begun to improve, and by the end of a month he had gotten considerable space visible between the tonsils and uvula. At the end of two months lie had gained fifteen pounds, and at the end of three twenty-eight pounds. All the tonsils had diminished very markedly in size, so that one could put two fingers if not three between the faucial tonsils. The lingual tonsil had sunk out of sight, so that it was hardly visible on direct examination; the epiglottis was raised so that one could see into the laryux, and the palate had come down nearly to its normal position, so that I was able to see the pharynx tonsil, which I had known to be increased. in size, by seeing it through the nose, and which was at one time

nearly if not quite as large as was the lingual tonsil.

During these weeks that had elapsed by careful questioning of his family they had recalled some facts concerning his past history. As a young man of twenty or twenty-five years of age he had had lymph nodes swell to the size of a large hen's egg underneath one arm, and they had subsided again without external rupture. This happened within a few years certainly five or six times, and on each occasion with the same history of swelling, tenderness, threatening to rupture, but finally disappearing without any external break in the skin.

In October, when he first came back in such a bad physical condition, it had been quite easy to discover that his spleen was slightly enlarged, but no lymph nodes other than in the neck anywhere in the body seemed to be at all increased in size. An examination of the blood at the time of this great improvement showed it so nearly normal that it would have been very difficult to distinguish it from that of a per-

fectly healthy individual.

He was, however, improvident and careless now, as he had been all his life, ceased to take his medicine, and I saw nothing of him from February 23, 1900, until May 24th, when he returned with everything just as bad if not worse than at any time since the start. The tonsils absolutely met in the centre of the throat (this is the entry of July 3d), and for the last three months he has taken no arsenic whatsoever. drifted along without a great deal of care, not presenting himself again until January 20, 1901. He again had taken no arsenic for three The tonsils were larger than it would seem possible could exist in the mouth of any individual. He now has a lump on the side of the neck under each sternocleidomastoid, and one at the end of the jaw, and on the right side one further down near the clavicle, and one under the arm. He was again started on the same regimé as before, when everything again seemed to improve; but on February 15th he reported as not having done so well lately in spite of regular treatment. The tonsils had rather increased, if anything, over what they were a month ago. In the substance of the hard palate there had come a swelling, hanging down into the mouth with spots of pressure necrosis. The lymph nodes all over the body were enlarged. He became very weak, and from this time on was confined to the house.

During the previous November he had a pneumonia, which ran a course of one week and left him prostrated in bed for the two succeeding. While in bed he noticed a swelling on the left side of the head in front of the ear, which increased in two weeks to the size of a walnut. Shortly after this a swelling appeared over the mastoid process of the right temporal bone. These and the swollen condition described in the palate remained until he died. The blood was now found to contain a great many more white blood cells than formerly, but nothing like the condition of enormous increase which one some-

times sees in lymphatic leukæmia.

Through all of this his kidneys, bowels, and other internal organs seemed to operate perfectly successfully and comfortably. By February 14th in front of the left ear a tumor the size of a hen's egg rather rapidly developed, freely movable all the time under the skin. The tumor at the back of the ear increased in size. The difficulty in swallowing now proved to be a serious impediment, and adequate nutrition

could not be accomplished. It was suggested to give rectal alimentation, but the patient bore it very poorly. Fowler's solution, while accepted and borne as far as the stomach was concerned, seemed to have absolutely no effect, and the patient gradually grew weaker, until he died from exhaustion, on March 4th, about two years from the time

when he first noticed his tonsils enlarging.

Other than the slight pressure necrosis which occurred in the tumor in the hard palate nothing approaching breaking down or the forma-tion of pus took place in any of the nodes. The family refused an autopsy, but we were allowed to excise a portion of one of the nodes of the neck and of the tumor in the mouth, and they revealed by microscopic study simple lymphoid hypertrophies. In the specimens as we were able to get them there was no regularity of structure, the lymphnode formation having apparently been so interfered with in the rapid growth as to be obliterated. A very careful study of the cells, I am sorry to say, was not carried out, but in general I am confident that there was no increase in the large polymorphonuclear cells or in any except the small lymphocytes. The tissue was not stained for tubercle bacilli.

Plainly here, it seems to me, we have had to deal with a general systemic trouble expressing itself first and foremost in the tonsils, the entire ring of lymphoid tissue being involved. This is quite different from the case to be briefly mentioned in a moment of acute Hodgkin's discase, beginning by infection of the tonsils. It is, in fact, the absolute reverse. In an individual formerly subject to adenopathies came a gradual and persistent enlargement of the tonsils. The appearance, as has been stated, was entirely different from the usual hypertrophies, and there surely was nothing of the inflammatory type. Then the marked diminution in size under Fowler's solution was so evident that nothing more was needed to demonstrate that the enlargement was due to constitutional dyscrasia. Also the fact that during his periods of improvement the blood reached normal, and his increase in weight and other changes showed how certainly the general system was responsible for the condition of the tonsillar tissues. Hence, we are justified in concluding that we here had to do with a case of lymphadenoma,1 the first tissue to be affected being the tonsils, and it seems to demonstrate what oftentimes has been overlooked and forgotten, that these collections of lymphoid tissue known as tonsils are not merely what the word "lymphoid" derivatively signifies—i. e., like or resembling lymph tissue—but really are integral parts of the lymphatic system.

This case, then, comes with peculiar force to demonstrate this connection, and would seem, therefore, to present unanswerable arguments if the question of the function of the tonsils was under consideration.

¹ There was nothing about the patient suggestive of tuberculosis, and yet it is exactly in this kind of a patient that the latter is present sooner or later.

It will be remembered that radical observers have arisen who contend that the tonsil is always a pathological product. If so, then, are all lymph nodes, Peyer's patches, and solitary follicles in the intestine abnormal? We have long had evidence that systemic conditions influence the tonsil, such as the diminution in size of the whole lymphoid tissues and marked falling off of the number of cells in the follicles, and also great lessening of the emigrants to the surface in profound wasting diseases, as, for example, chronic suppuration.

The case referred to earlier proved how overwhelming an infection from tonsil tissue can be when a young man of twenty is suddenly stricken with acute Hodgkin's disease following a simple streptococcus tonsillitis and dies within six days. Evidently there must have been some direct opening into the lymphatic current, and this we know exists just as surely in the tonsils as in any other lymph node. In this particular case the result could not have been more rapid had a pure culture of germs been injected directly into the lymphatic node or tonsil.

These two cases, each in its own way, demonstrate to my mind the absolute "oneness," to borrow a term from the disciples of Mrs. Eddy, of the general lymphatic system and the tonsils, even if we lacked other and more objective anatomical proofs. An inflammation of the tonsils in the one case fatally diseases the whole lymphatic system. In the other case a fatal disease purely of the lymphatic system swells the tonsils as the first nodes to become diseased, and then the others all over the body.

To speak of objective or anatomical proofs, it is known to all that structurally the tonsils are like the lymph nodes in almost every detail, only that they have no afferent lymph vessels. They are terminal nodes with lymph vessels leading away from them to the main lymphatic trunks, and so their cell elements go directly into the circulation as do those of any other lymph node.

If one were to attempt to sum up the physiology of the tonsil it might be succinctly stated that the functions of the tonsils were those of the lymph node, only that these particular nodes absorbed directly from the mouth and pharynx instead of taking the fluids brought to them from the surrounding tissues.

Analogous conditions exist in other parts of the body, such as, for example, the well-known process of absorbing the contents of the intestines directly into the lacteals. Here fluids are absorbed directly into the lymphatic trunks, and they go immediately to the general lymphatic current, explaining toxemias arising from the intestine along similar lines with those produced by the tonsils.

Just why the tonsillar ring exists where it does is not quite clearly evident. It apparently represents a meeting-place of the embryonic

epiblast and hypoblast, and is early in evidence in the young life of the embryo, fully equipped for work when the child is born. Early testimony of the absorptive power occurs in the enlargement of the lymph nodes lying on the anterior surface of the spinal column, and suppuration of these makes the well-known cases of retropharyngeal abscess. Probably the absorption is from the pharynx tonsil. Later, the anatomists tell us, these nodes disappear, and usually in the adult there is only one large lymph node, which is on the ventral surface of the atlas, and the absorbed materials go to the other nodes, than in the young babe, probably to those in the region of the hyoid bone. With design and purpose even in the earliest days of the life of the individual the tonsils begin their work of absorption, and so may be reasonably concluded to normally exist with the intention of the Creator rather than as a purely pathological product.

All this and more could easily be believed to be but following the natural lines of thought in the application of the simple theme suggested by our text. Very well-worn truths many of them, I hear you say, but may they not for all that bear once more the light of your intelligent scrutiny? It has seemed to me that we have all along missed something somewhere in explaining the different conditions as we meet them in childhood. Simply because an event is an every-day occurrence is no reason why we should not try to explain it. Quite the contrary. What constitutes the condition known as "delicate," always catching cold, never strong, present, and most in evidence, perhaps, in the childhood of an individual? If he lives to adult life he never is free from it, and when hoary with age he folds himself in abundant wraps to supply what his system should have inherently been able to do in the way of protection from draughts and colds. Have we not come, general practitioners and specialists alike, to think of the tonsils as a concrete entity, an excrescence in the throat? If they get big and in the way, chop them off, any way to get rid of them, and then, proud in the consciousness of a righteous act bravely done, do we not forget that often but a small projecting fragment has been removed? Do we not as serenely contemplate our work as thoroughly accomplished as if we have pulled a tooth or ablated a wart! Or, put the picture the other way. We glance into the throat at these excrescences, the tonsils. They are seemingly not in the way, and we dismiss them as thoroughly from our minds as of no interest to us and certainly of no moment to their host, and as easily as we might a wen or a mole. But anon the victim in question is sick; temperature, fever, violent head-All that he has is a little spot on one tonsil—a very trifling thing, but fraught with what consequences? It may be a diphtheria, scptic poisoning results; the patient dies of heart failure. It may be a streptococcus inflammation and produce general joint rheumatism, endocarditis, or, as already referred to, acute Hodgkin's disease. It may be in a young child, and the tonsil inflamed be the pharynx tonsil up behind the palate, out of sight, where we may not even see the spot, and the result is not only a mighty disturbance of the general system, but the cervical lymph nodes enlarge, perhaps later the supraclavicular, and later still the bronchial. Perhaps one or another of these enlarged nodes stays and holds up a tubercular germ. For the time being it may completely encapsulate and swallow it up, and yet years after, when something overwhelms the host in the pride of young womanhood or manhood, the germ is let loose into the system and there results a fatal, quickly progressing tuberculosis.

Why is it that such an overwhelming majority—over 70 per cent. of all children in foundling institutions, when dead from any cause, have enlarged bronchial nodes? What is it that happens when the young child, after the simplest of these acute seizures in the third tonsil, goes around for months, perhaps years, pale, seemingly anemic, yet not demonstrably so, easily knocked out by the slightest affection, the nodes in the neck often swollen and tender even after the original seizure is long passed, never seeming to get quite up to the measure of resistance which was formerly his or hers? Or, let us reduce the matter to its simplest terms. Why should a great, healthy, robust adult be so completely felled by a few small follicular spots on this unimportant excrescence, the tonsil? If we ever stop to ask ourselves the question I fear we have all too often fallen into the habit of the old country philosopher, when some new problem was presented to him, of giving the lucid explanation, "It's a way things has." Tonsils certainly do have this way of doing, and in most instances that explanation will suffice. But when we are considering as to-night, can we not go a step farther on along logical lines and say that it is easy to thus poison the system, because when the tonsil is diseased a part of the lymphatic systemi. e., the blood-making or blood-cleansing system—is involved; hence, therefore, the blood itself? A hypodermic injection gives maximum effects from minimum doses, because it is absorbed directly into the circulation. When any germ or poison enters the tonsil, unless arrested there or in the near-lying nodes, it eventually enters the blood stream, getting maximum effects from a very small area of disease.

Is there any anatomical reason why the results of tonsillar infection are more widespread as regards the lymphatic system in children, as a rule, than it is in adults? Of course, we are bound to bear in mind, when asking this question, the general statement that immature tissue resists less vigorously than that better organized and older.

When that distinguished observer Sappey, whose monumental work on the lymphatics will last for all time, could not get good injections of the lymph vessels in any given part, he learned to go to the newborn

babe or very young infant. Here he could get results with greater ease, because the channels were open, the vessels were fully developed. and many of the beautiful plates illustrating his atlas were thus made possible.

Therefore, it is easy to see how much greater freedom to run riot within the lymphatic system the poisonous or diseased substances have in the infant over the adult, and why the lymph nodes themselves have a great burden thrown upon them to filter off material thus easily gaining an access to the lymph current, and, if you will, how very dependent the future of that individual is upon the activity and intactness of these nodes and their physiological functions!

Now, of all the parts of the lymphoid ring the pharynx tonsil is the one most frequently attacked in the young infant, and, therefore, inflammations of it are most liable to endanger the general system. There is some evidence that the pharynx tonsil is the earliest to acquire full development. In any case it is the one which at birth stands ready for business. So it is reasonable to suppose that it would be the one to most frequently become diseased in the early years of life—a fact long known clinically.

We have led up logically to this point as perhaps of chiefest importance, certainly, to my mind, most vital; and if I am allowed to say anything further I should like very briefly to dwell on the question of acute inflammation of the pharynx tonsil in children.

Only within the last two years has one been able to observe any attention as paid in current literature to this acute inflammation of the pharynx tonsil. So much has been written about the chronic enlargement that the acute seizures have been passed over, largely because it is only lately that we have begun to recognize some of their far-reaching consequences.

Time does not permit me to give you any extensive description of this acute inflammation. That I have already done in another place; but I would like to emphasize the fact that some of the cases are easily missed and yet most significant in their results.

It is superfluous to speak before this audience further of what is well known to all of you of the typical, well-developed acute eases of tonsillar inflammation in the nasopharynx, but there are certain of these masked cases that escaped, and may for some time to come fail of intelligent eonsideration. The briefest way to mention the matter to-night will be to relate an absolutely typical masked case, and make a few critical remarks upon it in closing what is even now a lengthy paper.

I was called last April to attend a child whom I had often seen before. He possessed to my knowledge slight tonsillar enlargement, but was not by any means a mouth-breather, nor did I know of any-

thing wrong in his nasopharynx. He had, at the time of my visit, a high fever, headache, and slight snuffles; no cough, no sore-throat; slight ringing in the ears. Patient impressed one as being sick and demanding intelligent attention, and so was looked over very thoroughly. I examined the chest, tonsils, nose, and larynx, and could find as the only spot which showed trouble a very red, very moderately swollen, slightly spotted third tonsil. I gave my opinion that the cause of the trouble was there and there only.

I saw the patient the next day, and his fever had gone up in the afternoon higher than on the previous day, with a morning remission to nearly normal. There was no change in the physical condition except that the head ached harder. There was no cough, and the only sign of discharge from the nose on this second day was a slight sticky condition of the mucus around the entrance to the nostrils. The family physician was called in order that he might discover something that I might have omitted, and accepted with considerable mental reservation my diagnosis. He proposed, as I was very thankful that he did, to give the patient a thorough overhauling again. He found absolutely nothing that he could conscientiously say was productive of the symptoms, and on the following day, when the fever still persisted, not any higher, but with less remission, he, fearing that there might be something more in the case than we had either of us supposed, had the blood examined, made another thorough examination of the whole body, and still nothing developed.

During the following three days the temperature stayed considerably above 100°, but no other identical symptoms developed except that the lymph nodes in the neck at the angle of the jaw and further down under the sternocleidomastoid muscle became slightly puffed, very soft, and quite tender. Some weeks of general malaise and slight febrile rise at night followed. He dragged around with no ambition, and could not be made to pick up in weight, and the family made an early trip away to Maine for the summer. It took him some months to

establish anything like his former vigorous condition.

If this were a single instance it would seem hardly probable that we had ruled out every possible condition leading to general dyscrasia, but it has happened again and again in other patients where it was well known that the adenoids existed and where these acute attacks, slightly different from the present, had been frequently enough observed to know where to lay the blame.

In this case the patient was old enough and tractable enough to allow of a posterior rhinoscopy, and there was no doubt of the existence of this follicular inflammation in the pharynx tonsil.

Through some three or four years that I have been in my own mind developing some of the ideas here expressed, I have had occasion to be intimately associated and to know of numerous such cases, and it has left in my mind not a doubt as to the fact that we had to deal later in this case with a distinct interference with or disturbance of the function of the lymphatic system, and it has developed therefrom that we might possibly explain why certain children would for years and years possess

the same characteristics as these patients surely have shown during the months or years that some of them have been under observation. And if this is so, if any of the deductions that we have made from this are even in part true, then it has become high time that the profession as a whole, and we, all of us, should view the tonsil as not merely an irresponsible, functionless lump of matter existing in the throats of our patients, but as an organ which, if not doing its full physiological duty or if diseased, can modify and influence some of the most vital functions of the lymph and blood. So, therefore, we who deal with the subject from the specialist's point of view can least of all afford to place ourselves in a position which shall seem inappreciative of these long-known and well-recognized physiological principles; for by so doing we throw ourselves open to the oft-repeated taunt that we take too narrow a view of our work, failing in many instances to at all consider the general system as we ablate tonsil after tonsil.

What should be the practical deduction from such theorizing as we have indulged in during these remarks? Surely, it is not to give free rein to indiscriminate attempts at removal of tonsils first, second, or third, and surely it would not argue that we must let them alone. seems to me the practical point is that when we operate, to be thorough in what we do, and when it is done, be it ever so thoroughly, it must still be borne in mind that we have some tonsillar tissue left. sillar tissue is normal to the human body, therefore, the patient thus operated upon has all the chances that a normal tissue always has of becoming infected or diseased. We have, therefore, not given our patients immunity because we have operated; we have only given them less liability, and we should, in the line of what we are now saying, never dismiss patients as needing no further thought, because, forsooth, they have received our skilful manipulations in the nasopharyux or pharynx. Surely, there is a broad field for progressive work along the lines of strengthening the bulwarks which nature has endeavored to erect that there may not happen to the little people in our charge some of these dire disasters, which have been mentioned in the early part of the paper, as coming from trifling affections of the tonsils. How can these be avoided? At present the way does not always seem quite clear, but it will never be if we do not occasionally ponder over the matter and endeavor to clear as much of the mist of doubt as is permitted to us, each in his own way and time.

THE INDICATIONS FOR OPERATIVE INTERVENTION IN MIDDLE-EAR SUPPURATION.

By BARTON H. POTTS, M.D.,

ASSOCIATE IN DISEASES OF THE EAR IN THE PHILADELPHIA POLYCLINIC; AURIST AND LARYN-GOLOGIST TO ST. MARY'S HOSPITAL; AURIST AND LARYNGOLOGIST TO THE OUT-PATIENT DEPARTMENT OF THE GERMAN HOSPITAL; ASSISTANT OPHTHALMIC AND AURAL SURGEON TO THE CHILDREN'S HOSPITAL, PHILADELPHIA.

When to operate or to advise operation in cases of chronic suppurative otitis media is a question that is constantly being asked of the aurist, and it is one that is not always easily answered. Many patients live to a ripe old age without any serious trouble from a discharging ear; but it is without doubt that many have died from an overlooked or neglected aural condition whose lives might have been saved by operative interference. A discharging ear is not now treated with the same indifference as formerly; it has become more widely recognized that the ear is a part of the body, and that disease of this organ may affect the general health as much as disease of any other organ.

Intracranial complication is, of course, the condition to be dreaded, and, while it is comparatively infrequent, it is always dangerous. It is impossible to make up a complete list of the cases of otitis media that have been complicated by intracranial involvement, but the apparent proportion is increasing as the advance in aural work is being better understood and the diagnosis more scientifically made.

The chief point in our diagnosis is to determine the cause of the dis-If the latter consists chiefly of stringy, ropy mucus, we will almost surely find the exciting cause to lie in the Eustachian tube or nasopharynx; but if the discharge is seropurulent or a creamy pus, and especially if it is very profuse and of long duration, we must look to the tympanum or mastoid; and it is this type of case that is referred to in this article. No definite rule can be made for these cases, for each must be studied upon its own merits. The discharge in itself is not much of a guide to us, except that a very profuse and longcontinued flow would point to the involvement of a greater area than that comprised in the tympanum alone. Careful search must be made for necrosed bone within the tympanum, and if found this should be treated on proper surgical principles. Curetting must be done and thorough drainage established; if these measures as done through the canal fail, more radical treatment will be necessary, and the question of an operation on the antrum or mastoid must be decided.

When we have a large fluctuating swelling behind the auricle our course is generally plain; but when there is no swelling or induration, when even tenderness over the mastoid may be absent, our course of

procedure may not be so clearly evident. Too much importance should not be given to the symptom—for it is only a symptom—of fluctuation behind the auricle. Having eliminated the possibility of glandular involvement or of a furuncle or other inflammation of the external ear, we know that this swelling is a symptom of inflammation in the antrum or mastoid cells; but that this inflammation may exist in the deeper tissues without the presence of swelling has been proven very frequently. Many cases have been seen in which this swelling disappeared coincidently with a free flow of pus from the canal; unfortunately, this is regarded by the patient, and sometimes by the physiciau, as a great improvement and they rest satisfied until further, and generally more serious, trouble follows. Its true meaning is simply this: the pus has found a passageway for itself through the tympanum or through a sinus and thus evacuated the abscess cavity; but the inflammation of the deep tissues, which is the cause of the pus, still continues active. To consider a suppurative mastoiditis well, or even improved, simply because the swelling has disappeared is a decided mistake.

Local tenderness is an important sign in these cases; careful palpation will, in the majority of cases, elicit tenderness over the inflamed region, the point of greatest tenderness usually being found over the antrum, and persistent tenderness in this locality is a pretty sure sign of inflammation of the deep tissues. Tenderness over the mastoid tip is not of such great importance, except in those cases in which the pus has forced its way through the inner wall of the tip into the digastric fossa.

But, though usually present, tenderness may be entirely absent; this is more apt to be the case when suppuration is of very long standing. In these cases we are almost sure to find that a sclerotic process in the mastoid has changed completely the character of the bone; instead of cellular structure we may find a dense layer almost as hard as ivory; this change may be confined to the outer table alone or may extend to the antrum, and this may be obliterated, though not usually. layer of dense bone may so effectually protect the inflamed deeper parts that we may be unable to elicit any tenderness even by the firmest pressure. By making pressure first over one mastoid and then over the other, the patient can sometimes by contrast aid in our diagnosis. Œdema behind the auricle will probably be found to be due quite often to furuncle or other inflammation of the external ear, and it will be difficult to determine the cause of the swelling. A point mentioned by Randall will aid us, i.e., if in making our pressure over the mastoid and carefully avoiding the auricle we get pain, we may feel certain that the trouble lies in the mastoid; but if the pain is felt only when moving the anricle, we will find the trouble somewhere in the external car.

One of the most important symptoms of all is an inflamed, tender, and bulging upper posterior canal wall and membrane. This condition in chronic suppurative otitis media is an almost certain indication of autrum or mastoid inflammation, and the failure of this condition to improve under treatment is one of our surest indications for operation.

The state of the general health is a guide in some cases, especially in adults. Children seem to be able to carry pus in the mastoid with much less apparent effect on their health; they are frequently seen with a history indicating a mastoid involvement extending over a considerable period of time, yet showing little or no impairment of health. But, unless there be very free drainage, an adult will generally show constitutional symptoms within a short time, and the sudden and rapid failure of health, with a history of chronic suppurative otitis media, is a very significant sign.

The temperature in adults is not so important as in children; the former will have pus in the mastoid for a considerable time and present little or no elevation of temperature, while a child will rarely have pus for any length of time without showing some pyrexia. This would not apply to pyæmic cases or those having a septic thrombus, for in these cases the extreme variations of temperature is the most significant sign of all, whether the patient be a child or an adult; here we have the temperature that is characteristic of pus, fluctuating rapidly through a range of four, six, or even eight degrees. When the sinus is thrombosed we frequently find tenderness extending back toward the occiput, and there will often be some bogginess just below the occipital bone. Tenderness along the jugular must be carefully searched for, as it is an important diagnostic sign in these cases.

Intracranial complications are the ones to be most dreaded; their development is generally so gradual and often so free from symptoms, that it may not be until an advanced stage has been reached that they come under the aurist's care and a diagnosis is possible. Even under careful observation the condition may not be certainly determined, and it is not until the inequality or the sluggislness of the pupils, rapid failure of strength, rigors or convulsions, elevation or subnormal reduction of temperature and slowness of pulse occur that the diagnosis is made with any degree of certainty. The variations of temperature and slowing of the pulse is the most characteristic sign and the one most often noted, and when present usually indicates intracerebral pressure. Von Bergmann (Arch. f. klin. Chirurgie, vol. xxvi.) says the position of brain abscesses of otitic origin is typical, viz., either in the temporal lobe or in the hemisphere of the cerebellum of the diseased side.

In regard to the clinical importance of the micro-organisms congerned in these processes the various authors differ. Randall teaches that the majority of the acute infections are due to the pneumococcus, and that this organism is the most prone to cause meningitis and other intracranial affections of a toxic type; while the bone lesions generally show the streptococcus or staphylococcus either as the primary or complicating infection, which is the worst in mixed cases. Gorham Bacon (Manual of Otology) has long insisted on the importance of the streptococcus, and has been foremost in America in urging routine bacteriological examinations.

The presence of a sinus leading into the mastoid, whether from behind the auricle or along the canal wall, is a positive indication for operation. Masses of granulation tissue along the canal wall should always be studied with great care, for they are suggestive of exposed bone or a sinus.

Facial palsy is not of much significance, for we know that it occurs in many cases in which there is no mastoid involvement; but that this symptom may be caused by a suppurative mastoiditis was demonstrated to the writer, who had the pleasure of seeing a ten-day-old palsy clear up within seventy-two hours after operation.

Epileptiform attacks are very unusual, but they were present in one of the writer's cases, so that it was for relief from this symptom that the patient applied for treatment and not on account of the discharging ear.

Even with the above points borne carefully in mind, cases will be met in which it will be difficult to determine the question of operation. Some authors go so far as to say that it is a mistake to try to cure chronic suppurative otitis media by the milder methods of antiseptic douching, curetting of the tympanum, etc.; but in the opinion of others this extremely radical position does not find favor. Certainly many cases have been seen in which the discharge ceased under the local treatment and the ears have remained dry during a number of years. Under present methods the operation is so nearly free from danger and from disastrous after-effects, that except from a cosmetic standpoint some aurists prefer to operate and find it to have been unnecessary rather than to fail to operate in one case where it may have been needed.

The treatment in the cases of mastoiditis complicating chronic suppurative otitis media must be vigorous from the start. If the mastoid involvement is acute the first and most important step is to put the patient to bed and keep him there at perfect rest. He should be put upon a light diet and given a saline purge. Calomel is very favorably regarded by some men, especially if the mastoiditis is due to an acute otitis media. Its full administration, however, must be restricted to those patients of a fairly robust habit.

The application of leeches over the mastoid has been pretty generally

abandoned, as it has been found much more efficacious to secure local depletion by the very free incision of the membrane and canal wall, so as to secure profuse bleeding and relieve tension in the antrum. This opening into the tympanum should be made very early, not only to secure depletion, but also to permit of free drainage. To secure relief from this condition without resort to more radical measures, it is absolutely necessary to establish free drainage. Following this incision hot douching is one of our most efficient remedies; to accomplish results this douching must be copious, frequent, and hot. It is usually well to begin with a temperature of 110° F. and increase this to 112° to 114° F., using not less than half a pint at each time. As little force as possible should be used, the water being allowed to gently flow in and out of the ear, and it is usually well to douche at first every hour for several times and then every second or third hour. In the interim of hot syringing the application of dry heat over the mastoid is of value; this is best applied by means of a hot-water bag, hot salt or hop bag; but moist applications, such as poultices, hot onions, etc., are to be strictly avoided. Protection by compress and bandage should be continuous between douches; external heat being applied outside of it.

The application of cold over the mastoid is sometimes beneficial, but should be used carefully and, as a rule, its use should not be prolonged beyond forty-eight hours. The application should be continuous, and if, after removal, there should be a return of the symptoms it would not be advisable to reapply it, for it would mean that the cold is simply relieving the symptoms, but that the inflammation is still present, and that more radical measures are necessary. Some authors say that the cold should never be used in cases of streptococcus infection.

Various measures are recommended by different men, but opinions as to their usefulness are contradictory; and the mercurial and saline, the early paracentesis and hot douching seem to give much the best result. When the milder methods of treatment fail more radical ones must be adopted; but nobody wishes to have his mastoid opened unless it is absolutely necessary, so that this should be held as a later resort. On the other hand, too long delay is attended with much greater danger than too early intervention, for the opening of the mastoid cells through to the antrum is not in itself a dangerous procedure, and the opinion is very generally held that in obscure cases, when treatment has failed, the exploratory opening into the antrum is indicated.

What shall be the form of operation is an important question to decide. The consensus of opinion seems to be that the original Schwartze operation—opening through the mastoid cells into the antrum—is sufficient only in those cases when the mastoiditis is acute and without the history of chronic suppurative otitis media; but when

the latter is present it is necessary to more thoroughly clean up the attie and antrum and give more free and lasting drainage. When the mastoid eells are not involved, this is best accomplished by the Stacke operation, which consists in laying forward the auriele, as in the regular mastoid operation, and separating the membranous from the bony eanal by a blunt instrument; a portion of the upper posterior eanal wall is removed and all parts of the tympanum, viz., the antrum, attie, and tympanum proper, are thrown into one large cavity.

If, however, the mastoid cells are involved, it will be necessary to do the more radical operation, which has been called the tympano-mastoid exenteration. The name explains the operation. Every partiele of earious bone is removed from the mastoid and the posterior eanal wall and seutum; the membrane and ossicles, if present, are removed and this region thrown into one large eavity. The wound behind the auricle is generally closed at the time of the operation and drainage carried out through the canal.

The following eases will serve to illustrate the points of diagnosis mentioned:

Case I.-I. R. M., aged five years. In this case there had been a discharge from both ears for more than two years following an attack of scarlet fever. He had been treated with fair regularity by different physicians, and had his adenoids removed. When first seen there were large masses of granulation tissue in both tympani; the discharge was profuse, but no exposed bone could be detected, and there was no mastoid tenderness. During a two months' course of treatment the granulations were gotten rid of, the discharge had greatly diminished, and the patient was apparently improving; but at the end of two months he missed a few visits, having been placed under the care of his family physician for general treatment owing to a sudden failure of health and strength. As there was no improvement he was seen in eonsultation. There was very little discharge from the left ear and none from the right. The upper and posterior eanal wall of the right ear was red and tender, but not much swollen. Temperature 104° F. Some tenderness over the right mastoid, but not marked. A saline laxative was ordered and hot douehing started at once and pushed vigorously. Twenty-four hours later the temperature was 100° F.; there was some discharge from the right ear and an increase from that in the left. Tenderness over the mastoid had disappeared, and the eanal wall was less red, tender, and swollen. This apparent improvement continued for forty-eight hours, when his temperature went up to 105° F.; there was again some tenderness over the mastoid and the canal wall was more swollen and tender. It was decided to operate at once. A tympanomastoid exenteration was done; the mastoid found to be full of pus, the dura exposed in two places and the lateral sinus uneovered. An unfortunate aeeident occurred, but I do not believe it affected the result. While removing the canal wall a ledge of bone very unexpectedly gave way and the spoon shot across the mastoid cavity and opened the sinus; the bleeding was very profuse, but easily controlled by pressure.

The temperature dropped to 99° F. following the operation, but within fourteen hours reached 104° F. again, and fluctuated between 100° F. and 104° F. for seven days, when, in consultation with Dr. Randall, it was decided to explore the sinus for thrombosis. The wound in the sinus wall was found to be healed and the sinus itself free from thrombus; the jugular was exposed and it, too, found free. The temperature remained high and the patient gradually sank until

forty-eight hours after the second operation, when he died.

The opening of the sinus was unfortunate, but not necessarily fatal, as proven by the fact that it occurred in another case of the writer's, in which necrosis extended so deeply that the bulb of the jugular was nicked; the patient made a complete recovery. The same accident has happened to other operators a number of times without serious consequences other than the delay in the operation to check the bleeding. Pyæmia was doubtless the cause of death in this case, and the question suggested itself whether it would have been better to have opened the left mastoid as well as the right at the time of the first operation, even though no symptoms pointed to that side; it is doubtful if this would have saved the patient's life. An operation two months earlier would probably have given a different result; but except for the profuse discharge then there was no sign of mastoid involvement.

CASE II.—C. M. T., aged eight years. Discharge from left ear since she was a baby. Three days before operation, without any history of pain, a swelling appeared over the mastoid coincidently with the cessation of discharge; twenty-four hours later the pus again began to flow freely from the canal and the swelling over the mastoid disappeared. A tympanomastoid exenteration was done; the antrum and mastoid were full of granulations and pus, and the sinus was uncovered by

caries of its wall.

Here we have a swelling over the mastoid that disappeared at the end of forty-eight hours; but the condition found at the operation shows what a great mistake would have been made in considering this

case improved simply because the swelling had disappeared.

Case III.—M. B., aged twenty-six years. Profuse discharge and some odor from right ear for four years following a cold. No history of pain at any time, but firm pressure elicited tenderness over the antrum. There was a perforation in the upper posterior quadrant of the membrane. A six months' course of treatment failed to give any relief from discharge, and as some tenderness was present at times an operation was advised. The Stacke operation was performed and the antrum found to be full of granulations. Six weeks after the operation the discharge has ceased. In this case the profuse discharge and the occasional tenderness was suggestive of antral trouble and the operation confirmed the opinion.

CASE IV.—A. F., aged thirty years. Discharge from right ear for six years. Four months ago began to complain of pain behind the ear. Examination showed marked tenderness over the antrum; discharge scanty; some bulging in the anterior flaccid membrane with a pulsating perforation. Free paracentesis through the bulging membrane was done at once, and this followed by hot douching and saline laxatives. Relief followed this treatment immediately; but the symptoms recurred four times within five weeks and operation was advised. The tympanic exenteration was done and the antrum found to be full

of granulations. After several weeks' treatment the ease was discharged eured. She was seen two years later for impacted eerumen of the left

ear; there has been no further trouble in the right ear.

CASE V.—E. B., aged sixteen years. Discharge from right ear since childhood. Has had three absecses over the mastoid which were opened and then healed. Now presents a small sinus behind the auriele about 5 mm. in width, from which there is a very slight oozing. Membrane entirely destroyed; no tenderness at all; temperature normal. The tympanomastoid exenteration was done. The mastoid cells were obliterated to a large extent by the sclerosis that is generally present in these chronic cases, and through this hard bone a sinus passed, in a gradually widening track, to the antrum. The latter was full of granulations and pus. Healing was slow in this case, but complete at the end of four months.

CASE VI.—C. R., aged twenty-seven years. Discharge from left ear sinee childhood. Six times during the past ten years there has been a swelling over the mastoid, which opened spontaneously and was allowed to close. When first seen there had been no swelling for eight months and the soft tissues were completely healed. No pain or tenderness except at times of the swelling. There was a medium-sized perforation of the membrane up and posteriorly. Careful treatment for the suppurative otitis media was instituted and the patient watched. At the end of six weeks the discharge eeased and the ear was apparently in good condition; but on account of the history the patient was told to return every few weeks. The ear remained quiet for three months; then the patient reported with the history of pain and diseharge two days previously. The eanal was full of eholesteatomatous masses. The membrane was intact, the old perforation being closed by a depressed eleatrix. On the upper and posterior eanal wall was a mass of granulations and through this mass bare bone and what felt like a sinus could be detected. Temperature was normal. A tympanomastoid exenteration was done. Dense eieatrieial tissue, tightly bound down to the bone, was found over the mastoid; the bone to the depth of about 5 mm. was almost ivory-like in hardness, but from that point there was a eavity filled with pus and granulations. An opening through the tegmen exposed the dura and a sinus was found leading from the mastoid to the posterior wall. As in Case V., the healing was slow, requiring about five months, but it has been complete.

Cases V. and VI. show that the presence of a sinus leading into the mastoid, whatever its location, is a sufficient indication for operation, and they also serve to illustrate the inefficiency of the Wilde incision for any ease of true mastoiditis. In Case V. the absects was opened with a knife, in Case VI. it opened spontaneously; but the result was practically the same in each case.

Case VII.—J. S., aged forty years. Discharge from right ear for thirty-three years following searlet fever. During the past fourtcen weeks has been having attacks of vertigo, so ealled. The attacks would appear at any time during the day or night and with increasing frequency, so that he might have five within twenty-four hours; he became very dull, stupid, and irritable. The tympanic membrane was

intact, but showed a depressed cicatrix up and posteriorly. Lying loose on the floor of the canal was a sequestrum measuring $15 \times 5 \times 5$ mm, which had come through a sinus in the upper posterior canal wall and through this sinus the pus was flowing and showing a distinct pulsation. There was no tenderness over the mastoid and no swelling. Temperature 99° F. A tympanomastoid exenteration was done; in this case also the outer bone for about 4 mm. was extremely hard, but beyond this it was all one cavity. A small area of the tegmen was destroyed, exposing the dura; and posteriorly there was an extradural abscess about 25×35 mm.

Healing in this case was slow, requiring about five months, but it was perfect. Following the operation there were no epileptiform attacks for three weeks, but at that time one occurred; this was accompanied by a partial palsy of the right side of the face. Nothing of a suspicious nature was found about the site of the operation, and as the palsy cleared up entirely within three days it was probably due to the fact that the gauze was packed into the wound too tightly. There were four of the epileptiform attacks during the three months following the operation, but a course of bromides controlled them completely. The patient was seen fifteen months after the operation and was feeling bright and well and had gone back to his work, that of a day laborer.

The sinus, sequestrum, and epileptiform attacks, indicating the probability of cerebral pressure, presented an unmistakable and urgent indication for operation. This patient resembled Case VI. in the closing of the perforation of the membrane and the formation of a sinus

through the canal wall.

A brief review of the symptoms indicating operation in many cases of chronic suppurative otitis media would then be this:

Profuse and long-continued discharge suggestive, but not diagnostic,

of antrum or mastoid involvement.

The fluctuating swelling over the mastoid diagnostic when present, but its absence not contraindicating operation. Œdema behind the auricle is more apt to be due to furuncle. Tenderness over the mastoid, especially in the region of the antrum, of great significance whenever present, especially if it is persistent; but this may be doubtful or absent if the outer table is much sclerosed.

The inflamed, tender, and bulging upper and posterior canal wall, one of the most important signs of all, and its non-relief by treatment is a sure indication for operation. A sinus, whatever its location, leading into the mastoid is a positive indication.

Facial palsy of interest, but not important.

Epileptiform attacks unusual, but indicating possible cerebral pressure.

Marked and rapid failure of health, more apt to be found in adults than in children.

The temperature more apt to be elevated in children than in adults. The rapid fluctuation of temperature through a range of several degrees our most important sign in cases of pyemia.

The slow and thready pulse, out of proportion to the clevation of temperature, irregularity or sluggishness of pupils, rapid failure of health, rigors or convulsions, signs of intracranial pressure.

Tenderness and cedema over the occipital are very apt to be present when the sinus is thrombosed. Bacteriological examinations not positive, but important.

A XIPHOSTERNAL CRUNCHING SOUND.**

WITH A REPORT OF SIX CASES.

BY MYER SOLIS-COHEN, A.B., M.D., ASSISTANT PHYSICIAN TO THE MEDICAL DISPENSARY OF THE HOSPITAL OF THE UNIVERSITY OF PENNSYLVANIA, ETC.

As assistant to Professor M. Howard Fussell, Chief Physician to the Medical Dispensary of the Hospital of the University of Pennsylvania, I examine about one fourth of the patients applying to that service. Of 492 cases examined by me during a period of fifteen months, I observed in six (or 1½ per cent.) what I have termed a xiphosternal crunching sound. This sound is superficial in character, and may be compared to the sound caused by a boot treading on soft snow. It is heard over the lower end of the sternum and a little to the left of it. The exact area over which it is heard varies somewhat with each case. The upper margin was between the upper border of the fifth rib and the upper border of the sixth rib. The lower boundary ranged from a line drawn transversely through the base of the ensiform to one extending from the tip of the xiphoid to the junction of the seventh costal cartilage with the costal margin. The right border in every case lay between the right and left edges of the sternum. The left boundary was between the left mid-clavicular line and a line drawn an inch and a half to the left of the sternum and parallel with it. The sound was heard during the whole of the cardiac systole, but not during diastole. It varied in intensity, and occasionally slightly in position, but never in It was not influenced by exercise, respiration, or pressure with the stethoscope, except in one instance, in which it scemed to be increased when the stethoscope was pressed against the chest, and also when the patient had walked rapidly. When the patient leaned forward the sound became intensified (in every case but one), and when he lay down it diminished in intensity, in two cases completely disappearing. In every case the heart was enlarged, and the cardiac sounds

^{*} Read at Bethlehem on January 29, 1903, at the Winter Conversational Meeting of the Lehigh Valley Medical Association.

were weak and of poor quality. Retraction of the interspaces was noted in three cases. The pulse averaged about 82.

This sound is not described in any text-book on general medicine that I have examined, although I have searched the works of Allbutt, Anders, Barlow, Bartholow, Bennett, Bristowe, Chapman, Davis, Eichhorst, Fagge, Flint, Gibson, Gregory, Lockwood, Loomis, Lyman, Mackintosh, Money, Osler, Pepper, Reynold, Roberts, Roger, Stillé, Strümpell, Tanner, Taylor, Loomis-Thompson, Tyson, Watson, and Wood and Fitz. I have found no mention of it in any of the following standard text-books on diagnosis: Coiffier, Corwin, Da Costa, Debove and Achard, Edlefsen, Gibson and Russell, Hare, Hutchinson and Rainy, Jacob, Klemperer, Kuhnemann, v. Leube, Musser, Tyson, and Vierordt. Mayet, however, speaks of a xiphoidal exocardial or cardiopulmonary murmur resulting from the action of the heart against the lung. Butler speaks of a "friction sound heard over the lower end of the sternum and the adjoining costal cartilages, synchronous with the action of the heart," which, he thinks, "may be due to subphrenic peritonitis or abscess, or perhaps to a diaphragmatic pleuritis."

In their works on the heart no sound in any way resembling the xiphosternal crunching sound is mentioned by Barth and Roger, Balfour, Bellingham, Bertin, Billing, Blakiston, Broadbent, Bramwell, Clark, Da Costa, Flint, Fothergill, Gerhard, Gibson, Hayden, Hope, Keating and Edwards, Latham, Paul, Shapter, Walshe, Wardrop, Waters, or Watson.

In a careful review of the periodic literature treating of the heart and pericardium, I find very few references to a sound in any way resembling that forming the subject of this paper.

In 1826 Laennec,³ in speaking of certain phenomena that might be confounded with true cardiac murmurs, described a "metallic click heard over the præcordial region in subjects with nervous palpitation," which he believed to be produced by the impulse of the heart against the thoracic parietes. He also mentioned having observed in other cases in the same region a sound resembling "the creak of leather of a new saddle under the rider," which at one time he regarded as a sign of pericarditis, but later became convinced that it was not. It seemed to him to occur when the heart, enlarged or distended with blood, was crowded in the inferior mediastinum, as if there were bubbles of air in the pericardium.

Bouillaud, in 1835, and Aran, in 1843, referred to "the metallic tinkling sound" pointed out by Laennec, describing it as "a metallic clacking of more or less intensity, of which an idea may be formed by applying the palm of the hand on the ear and tapping lightly the back of this hand with the finger of the opposite hand."

William Stokes,6 in 1855, mentioned a case of probably fatty degen-

eration of the heart, in which he found over the right ventricle a rasping sound, which disappeared in a few days, after the application of a blister and the use of a few mercurial pills.

"Xiphisternal or Pericardial Chisel-sound, with its Practical Application," was the subject of a paper read in 1856 by F. J. Brown, in which he stated that "a chisel-sound at the lower end of the sternum is of frequent occurrence in persons that are in good health in all respects excepting dyspepsia. . . . The sound is that of a chisel or short plane used forcibly across the end of a piece of timber. It is single and synchronous with the systole. It varies in intensity, but never in character. . . . It is exocardial.

"The boundaries of the cardiac-percussion sound are extended more or less, oftentimes but slightly.

"The symptoms that commonly coexist with xiphisternal chisel-sound are those of a form of dyspepsia.

"The treatment of xiphisternal chisel-sound consists in the use of mild antiphlogistics and resolvents and in the local abstraction of blood, followed by counterirritations."

Twenty cases are reported in this article, some with complications, including cardiac hypertrophy (four cases), degeneration of the heart (one case), aortic disease (one case), rheumatism (two cases), ecthyma and chorea (one case), hypochondriasis (two cases), ovarian disorder (two cases), cerebral affection (two cases), and epistaxis and splenalgia (one case).

Brown is of the opinion that "the sound is due to 'white pericardial patches' plus toxemia," and that "the attendant dyspepsia is only sympathetic."

In 1882 Angel Money⁸ published the result of a series of very careful observations made on the hearts of 111 parturient and puerperal women who were admitted to a lying-in hospital over a period of six months. In 84 of these, or, roughly, 75 per cent., murmurs were heard, which were divided by Money into three sorts.

The "second sort (friction-like) was systolic in time, was almost absolutely not conducted, being heard only over a very small area to the left of the median line of the sternum. It sounded quite superficial, and was short and high-pitched and rather stiff in quality. This friction-like systolic murmur was to be heard just above and to the left of the ensiform cartilage. It was usually audible only over an area which might be covered by the small end (of moderate size) of the stethoscope. . . . The seat of the murmur would about correspond to the 'white patch' so often found on the right ventricle. I have no post-mortem evidence to offer on this point. My experience enables me to say that in all cases this murmur was a temporary phenomenon. The bruit was detected in 29 cases out of 111. It was the sole murmur in 22. It was associated

six times with a murmur of the first sort; twice with one of the third sort.

"I have stated my belief that the murmur is in some way related to a rubbing of the visceral over the parietal lamina of the pericardium, which laminæ may or may not be altered in some degree in structure."

Under the heading of "Rough, Scraping, Systolic Sounds Heard Over the Tricuspid Area and the Right Ventricle," A. E. Sansom, in his text-book published in 1892, takes issue with Money as to the origin of the sound described by the latter. He says:

"There can be no doubt that short, rough, systolic, seemingly very superficial sounds are often to be heard over the situation of the right ventricle in conditions which deviate in no notable way from the standard of health, and these may be very difficult (or impossible) of explanation. It is very improbable that these are due to 'milk spots,' or to any change in the pericardium, visceral or parietal. Such supposed thickenings over the pericardium are smooth and polished, and unlikely to give the peculiarly rough sound observed."

E. H. Colbeck, 10 in his work on *Diseases of the Heart*, published in 1901, says:

"A peculiar form of friction sound is sometimes heard over the right ventricle at the level of the fifth and sixth intercostal spaces, close to the left sternal edge and over the base of the ensiform cartilage. It is possibly associated with the formation of the 'white patch,' which may be observed on the underlying portion of the pericardium covering the heart. The sound is systolic in its relation to the cardiac cycle, and may at one time roughly resemble a reduplication of the first sound; at another, an endocardial bruit. It may vary in character between a faint click and a definite rub, and, as a rule, the intensity of the sound is greatly modified by changes in the position of the body. The sound is most commonly observed in downward displacement of the heart, due to emphysema, but it may be present under apparently normal conditions."

"An Undescribed Cardiac Sound" was the name applied by H. A. Hare" in 1901 to a "peculiar vibrating sound occurring with systole, and heard best in an area extending from one inch to the right of the sternum to one inch to the left of the nipple, on the nipple level, and which is sometimes so dry, if I may use such a term, that I have at times considered it somewhat like the pericardial friction sound heard in pericarditis near the base. That it is not a friction sound I am very confident, although I must admit that its cause is not clear. Personally I believe it to be due to vibrations in the chordæ tendinæ produced by imperfect contraction of their muscular attachments, because I have never met with the sound except in cases of general debility with a feeble irritable heart. . . . The sound I refer to is not a murmur in

the ordinary sense, but a vibratory sound resembling the sound 'ching' at each systole. It is short and quick, not changed by deep or superficial pressure of stethoscope, and is not entirely put aside by rest in many cases, although it is usually decreased by this means. It becomes accentuated by nervousness or fear, but not by exercise of a sufficiently violent kind to distinctly accentuate ordinary sounds."

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Osler12 in discussing Hare's paper said:

"There is a distinct difference in the majority of healthy hearts between the first sound over the apex and that as you move toward the sternum, a more crunching sound, which is peculiar and remarkable."

I called M. Howard Fussell's attention to the xiphosternal crunching sound exhibited by each of the six cases I am reporting. Dr. Fussell (1902, personal communication) in each case identified the phenomenon with a crunching sound frequently observed by him in cases of myocarditis, of neurasthenia, and in some cases of anamia; and he was of the opinion that the sound was produced in the cardiac muscle.

The histories of the six cases I have observed are appended.

The patients were all men, five white and one colored. The ages ranged from eighteen to sixty-three. All but one were married. The occupations included both light and heavy work.

The family history was negative except in one case, where the patient's mother had rheumatism and his brother had died of dropsy.

Two of the patients had indulged in alcohol to excess and two had not touched it at all. Three were addicted to excessive use of tobacco; one never employed it.

Inquiry into the previous medical history showed that the following diseases and symptoms had been complained of by the number of cases recorded:

Typhoid fever, 2; pleurisy, 1; rheumatism, 4; urticaria, 1; gonorrhea, 4; syphilis, 2; coryza, 3; sore-throat, 4; influenza, 4; hemorrhoids, 3; cough, 4; expectoration, 3; night sweats, 2; loss of ficsh and weight, 2; dyspepsia, 3; precordial pain, 2; dyspeca, 4; palpitation, 2; vertigo, 4; weakness, 5; edema, 3; headache, 2.

The symptoms complained of by the patients on admission, and during the course of their illness, follow:

Anorexia, 5; malaise, 4; weakness, 3; headache, 2; dyspnœa, 3; palpitation, 4; vertigo, 2; pain about the heart, 4; general soreness, 2; tenderness and soreness of the extremities, 3; pain in the shoulders and back, 4; nausea, 2; heartburn, 4; pain in the stomach, 4; abdominal pain, 4; eructation, 2; constipation, 2; diarrhea, 2; drowsiness, 3; distention of abdomen, 1; hemorrhoids, 3; expectoration, 5; sore-throat, 2; nasal trouble, 3; nose-bleed, 2; loss of weight, 1; headache, 3; seminal emissions, 4; oligoria, 2; nervousness, 1; urticaria, 1.

With two exceptions the patients on admission were well developed and well nourished. The pupillary reactions were normal. In four cases the tongue was coated. The pulse was regular in every case, weak in three, of low tension in two, and compressible in three. The rate varied from 60 to 104, the average being about 82. In four instances the radial arteries were fibrous. Pulsation was visible in the neck in two cases, below the clavicle in one, in the epigastrium in one, and at the apex in three. Expansion was diminished in two of the patients. Retraction was noted in the intercostal spaces in three cases, and at the epigastrium in two. One patient exhibited capillary engorgement; another, cyanosis. In every case the heart was enlarged, and with one exception, the cardiac sounds were weak and of poor quality. The lungs were negative in every case but one.

The blood count was practically normal. The hæmoglobin averaged about 85 per cent. The coagulation time was about two minutes.

The sputum in every case was negative.

Albumin was present in the urine in three cases; casts in two.

The examination of the stomach contents was made in two cases and a condition of subacidity found to be present.

The xiphosternal crunching sound, heard in every case, is a sound difficult to describe. In my notes taken before I decided upon this name, I employed various terms in describing it, using such expressions as "sounds of harsh clicking or rubbing character and high-pitched," "friction sound," "rough rubbing, clicking sound," "brushing sound," "sound resembling the rubbing together of two pieces of velvet," "scraping sound," and "that peculiar, gentle, rubbing sound."

The sound undoubtedly does vary somewhat; during an examination lasting fifteen minutes, it may be scarcely perceptible at one time, while quite loud and distinct at another. In only one case did it disappear entirely, and then but for a short time. I have been unable to discover to what influences the variations are due.

Notwithstanding the difficulty with which the sound is described, after it has once been heard it can instantly be recognized when observed again. I consequently believe that the sound heard in each of the six cases was of one and the same character.

But I cannot say that this is the sound heard by the authors I have quoted. I do not think that this is the sound referred to by Mayet, by Butler, by Bouillaud, or by Aran. It may have been the one compared by Laennec to the "creaking of leather," but probably was not that described as "a metallic click." It is my opinion, however, that the xiphosternal crunching sound heard by me is identical with the sounds described by Stokes, Brown, Money, Sansom, Colbeck, Hare, and Fussell.

The cause of this sound can only be a matter of conjecture until a sufficiently large number of autopsies have been made on cases which

have at one time exhibited this phenomenon. It is quite possible that the sound is produced in several ways. The sound that disappears under mild antiphlogistic treatment and the one that persists in spite of treatment may have different origins.

I do not think that the sound heard in my cases was caused by the impact of an enlarged heart on the lingula of the lungs, or by the friction-rub of pleuropericarditis. I incline to the view that it was due to the presence of white patches on the pericardium. This is not so irrational a supposition as some writers seem to believe.

In Allbutt's System of Medicine, F. F. Roberts13 says:

"From personal observation, however, I feel sure that some white spots or patches on the pericardium are capable of originating a limited friction sound."

Gibson,14 in speaking of pericarditis, says:

"Although the friction sound is almost pathognomonic, it is nevertheless sometimes, although not often, found in the absence of pericarditis. . . . Milk spots upon the pericardium, dryness of its surface, and ecchymoses into the subserous tissues have long been recognized as causes."

It is well known that white patches may be present on the pericardium without giving rise to a friction or crunching sound. It is quite possible that they cause this phenomenon only when associated with certain conditions of debility or of myocardial weakness. It seems also possible that the gastric irritation present in all of Brown's cases, and in five of mine, may have been due to a passive congestion of the gastric mucous membrane, secondary to the myocardial weakness.

Until more cases are reported of this fairly common condition, it will be impossible to form any conclusions; and until post-mortem examinations with this phenomenon in mind are made upon bodies that during life exhibited the xiphosternal crunching sound, nothing definite can be stated about its origin.

Report of Cases.

Case I.—H. W., male, aged twenty-eight years, a laborer, was admitted on March 13, 1902. The family history was negative. The patient had had measles, scarlet fever, influenza, hemorrhoids, a slight morning cough, with the expectoration of thick, tenacious sputum; dyspnæa, which was worse on exertion; and, more recently, night-sweats, loss of flesh, weight, and strength, and vertigo.

For the past two months he had suffered with soreness all over, but

For the past two months he had suffered with soreness all over, but most marked in the chest and legs, anorexia, and malaise. Several times a day he experienced nausea, which was worse on exertion. He

often had heartburn. His feet did not swell.

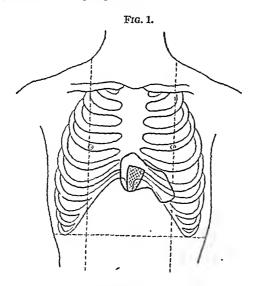
He was a well-developed but poorly-nourished man, with rather pale skin. His pupils were equal and reacted well to light and accommodation. His pulse was \$4, regular, rather weak, and of low tension.

The radial arteries were somewhat fibrous. The palms were moist. The tongue had a dirty yellow coating on the back part. The temperature was 98.8°. The chest and abdomen were of fair development. The movement of the chest seemed labored and rather restricted, especially on the right side. There was pulsation in the neck and below the clavicles. A fluttering pulsation was visible in the sixth interspace, in the left mid-clavicular line. There was slight bulging of the left chest with increased consistence, it being much firmer above the left clavicle than above the right.

The apex beat was not palpable. The heart was enlarged to the left. The sounds were heard best in the sixth interspace, the first and second sounds here being similar in character. The sounds were weak over

the body of the heart and at the base.

At the ensiform, and above and to the right of the apex, a harsh sound of a clicking or rubbing character, and high-pitched, was heard, synchronous with the heart sound, not increased by movement, and not noted when the patient was lying down.



The lungs presented no abnormality.

The abdomen was tender, but otherwise normal.

The extremities were normal.

The urine contained neither albumin nor sugar.

Examination of the sputum was negative.

The blood on examination showed: hæmoglobin, 92 per cent.; red blood cells, 5,000,000; leucocytes, 7440. The stained specimen was normal.

The patient improved under stomachic treatment.

The only symptoms of note while the patient was under observation were sore-throat, nose-bleed, soreness of scalp, and a papular eruption.

The peculiar cardiac sound was heard more plainly on March 17th; on April 5th it was increased by pressure with the stethoscope and after the patient walked rapidly, and did not disappear when he lay down; on April 11th it could not be heard at all; but on April 16th and on May 3d it was plainly audible.

The pulse on subsequent examinations was 76, 96, 80, and 80.

CASE II.—W. O., male, white, aged eighteen years, single, an upholsterer, was admitted on June 25, 1902. The family history and the past medical history were negative.

On admission, the patient complained of a constant though not severe pain in his stomach of a week's duration, at times relieved by eating, to return again in about an hour; of anorexia, malaise, and eructation.

The patient was a well-developed and well-nourished man. His pupils were equal and reacted normally. His tongue was clean. His pulse was 104, regular, of fair strength and tension, and compressible. The hands were somewhat cyanotic.

His chest was well developed, the right side being more prominent (a condition since birth). The sternum was depressed at its lower end. There was no epigastric pulsation. No retraction was visible anywhere.

Expansion was fair, though greater on the right than on the left.

A diffuse impulse was noted in the fifth interspace, left mid-clavicular line, and radiating to the fourth interspace above and to the left for several inches. The apex beat was distinctly felt in the fifth interspace,

several inches. The apex beat was distinctly felt in the fifth interspace, just inside the mid-clavicular line. The heart was enlarged to the right. The heart sounds were weak and lacking in muscular quality.

Over an area bounded, above, by the top of the fifth rib; below, by the lower edge of the sixth rib; on the right, by the mid-sternum; on the left, by a line an inch and a half to the left of the left sternal border, a rough, rubbing, clicking, brushing sound was heard, superficial in character. The sound was unchanged during inspiration or expiration, or when the breath was held at the end of inspiration or expiration. It was not increased by exercise, by pressure with the stethoscope, or by the patient leaning forward, but it was somewhat diminished when he lay down. The sound varied in intensity, but according to no discernible rule. The area over which the sound was heard always remained the same.

The lungs were normal.

There was no ædema of the legs. The knee-jerks were diminished.

The abdomen was normal.

The urine was acid in reaction and contained a slight trace of albumin, but no sugar. The microscope showed only bacteria.

The patient was put on stomachic treatment and at once began to

improve.

The presence of the peculiar cardiac sound was noted on July 15th,

and December 9th.

Case III.—C. S., white, aged sixty-three years, married, a carpenter by trade, was admitted on July 3, 1902. The family history was negative. The patient had had typhoid fever, influenza, gonorrhea, and hemorrhoids, and had suffered from recurring pains across the back,

dyspnæa on exertion, and occasional vertigo.

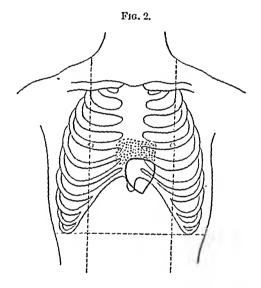
About a month before he applied to the dispensary, the patient had "caught cold." For the last two weeks he had had an uncomfortable feeling in his stomach, not influenced by his meals. He had felt some nausea, but had not vomited. On admission he complained of constant pain in his back over the right sacral region, at times leaving the back and going to the arms, the left lumbar or the umbilical regions. The patient had lost ten pounds in one month. His appetite was rather poor.

The patient was a thin man, having a somewhat shrivelled appearance. His pupils were normal. The tongue was coated. The pulse was 60,

regular, weak, of good tension, and not compressible. The radials were fibrous, but the temporals were not. There was some cyanosis of the hands.

Retraction during systole was noted in the region of the ensiform between the two costal margins, being more marked in the space between the xiphoid cartilage and the left costal border. It was increased on inspiration and greatly diminished on expiration. There was no movement of the ensiform itself.

The apex beat was neither visible nor palpable. The heart was enlarged to the left. The heart sounds were weak and were lacking in muscular quality. They were heard best in the sixth interspace, half an inch to the left of the mid-clavicular line, and were scarcely audible at the aortic cartilage and at the pulmonary area. A loud sound was heard in the region of the ensiform, being louder and most distinct over an area the size of a silver dollar,



bounded by the seventh rib, above; the tip of the ensiform, below; the middle of the xiphoid, on the right, and a line half an inch to the left of the costal margin, on the left. It was louder on inspiration and became much fainter when the patient was lying down. The sounds in the vessels of the neck were very faint. A rubbing sound, resembling the rubbing together of pieces of velvet, was heard over an area bounded: above, by the fifth rib; on the right, by the right sternal border; on the left, by a line beginning an inch and three-quarters to the left of the left sternal border and extending to the mid-clavicular line; and below by a line extending to the tip of the ensiform across to the left costal border, and then along the eighth costal cartilage. The sound was heard best over this area, but was transmitted a short distance. It did not seem to be affected by respiration, apparently being equally loud during inspiration and expiration, and when the breath was held at the end of either movement. Sometimes, however, it was noted louder during inspiration. It was not influenced by pressure with the stethoscope. It was a little louder when the patient leaned forward, and when he lay down it became much fainter.

The lungs and abdomen were normal.

The quantity of urine passed in the twenty-four hours was twenty-six ounces. The specific gravity was 1040. The urine was dark amber in color, clear, and acid in reaction. A trace of albumin was found, but no sugar. Under the microscope were seen hyaline, coarsely granular, and epithelial casts; cylindroids; leucocytes; renal epithelium, and crystals of uric acid and of calcium oxalate.

The sputum contained leucocytes and diplococci, but no tubercle

bacilli.

The blood contained 68 per cent. of hæmoglobin.

The patient improved under glonoin and Basham's mixture.

On November 25th and on December 11th the peculiar sound was still heard.

CASE IV.—S. W., white, an Hungarian, aged twenty-five years, married, a weaver by trade, was admitted on September 29, 1902, complaining chiefly of pains in his back, chest, arms, and legs. The family history was negative. The patient had had typhoid fever, urticaria, and occasionally sore-throat. For the past few years he had suffered with slight dyspnæa and palpitation on exertion, continuous headache, and

loss of flesh, weight, and strength.

The illness for which the patient applied had begun four months previous, with "a cold in the stomach," as the patient termed it, and with a diminution in the amount of urine passed. For a month or so past he had suffered from a burning sensation in the epigastrium and left hypochondrium after both dinner and supper, lasting three or four hours and accompanied by eructation. On admission, the patient complained of anorexia, malaise, and epigastric tenderness; of pains in his chest, back, arms, and legs, which were worse when the weather was bad; of dyspnæa and palpitation on exertion; of vertigo, and of weakness.

The patient was a well-developed, though poorly-nourished man. His conjunctiva, lips, and gums were pale. The left pupil was slightly larger than the right, but both pupils reacted normally to light and distance. The tongue was coated; the pulse was 72, regular, of fair strength and tension, and not compressible. The radials were not

fibrous.

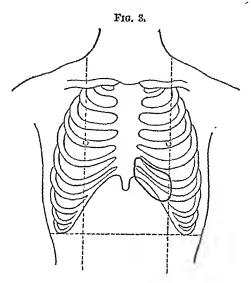
Expansion of the chest was good. In the fifth interspace, half an inch inside the mid-clavicular line, there was seen a slight fluttering, appearing as an impulse when the patient leaned forward, but more as a retraction when the patient stood erect. No other pulsations or retractions were visible.

The apex beat was not palpable. The heart was enlarged to the right. The heart sounds were weak and of poor quality, and were heard best in the fifth interspace in the mid-clavicular line. Over an area the size of a silver dollar, bounded above by the lower border of the fifth rib, below by the junction of the seventh rib with the sternum, on the right by the right sternal border, and on the left by a line one inch to the left of the left sternal border, was heard a rough and brushing, or rubbing or scraping sound, occurring during systole; observed during inspiration and expiration, and when the breath was held at the end of inspiration or expiration, but heard best near the end of expiration, and not influenced by pressure with the stethoscope or by exercise, When the patient leaned forward the sound was increased in intensity, and was heard over a larger area, which extended upward to the fourth

rib, and on the right to a little to the right of the right sternal border. When the patient was lying down the sound was not heard.

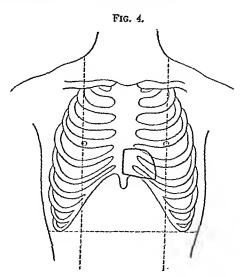
The lungs were resonant and the breath sounds were normal.

The abdomen was normal and the abdominal organs were normal. The boundaries of the stomach (inflated by means of a hand-ball syringe



attached to a stomach tube) were as follows: upper, fifth rib; lower, eighth interspace; left, a quarter of an inch to the left of the mid-clavicular line; right, the right costal border.

The patellar and plantar reflexes were absent.



The urine was amber in color, turbid, acid in reaction, and its specific gravity was 1025. It contained a trace of albumin, but no sugar. Under the microscope a few hyaline casts were seen; also, a few round, columnar, and squamous epithelial cells, and amorphous urates.

The sputum contained leucocytes, but no tubercle bacilli or any other

micro-organisms.

Examination of the blood resulted as follows: hæmoglobin, 91 per cent.; red blood cells, 4,000,000; leucocytes, 14,800; congulation time, two minutes. The red blood cells stained very faintly, but showed no There were a very few microcytes, megalocytes, degenerative changes. and poikilocytes. The different forms of the leucocytes were present in the following proportions: polynuclear neutrophiles, 57 per cent.; large mononuclear basophiles, 4 per cent.; small lymphocytes, 32 per cent.; eosinophiles, 7 per cent.

The stomach contents were examined two hours after an Ewald test breakfast had been ingested; 11 c.c. were expressed of a brown, chocolate-colored fluid, thick with undigested particles. Under the microscope starch-granules and a granular detritus of undigested matter were The reaction was acid. Free acids and free hydrochloric acid were present. There was no trace of lactic acid. 0.1 c.c. of a decinormal solution of sodium hydrate neutralized 1 c.c. of the filtrate.

The patient was put on the treatment advised by Dr. Brown (loc. cit.), consisting of pills of tartar emetic and extract of hyoscyamus, and of a mixture containing liquor ammoniæ acetatis and potassium iodide, which caused such nausea and vomiting, however, that it had to be dis-

continued.

The xiphosternal crunching sound was heard on subsequent exami-

The pulse at different times registered 72 and 88.

CASE V.—G. P., colored, aged forty-three years, married, a laborer, was admitted on October 3, 1902. The family history was negative. The patient denied having contracted syphilis. He had had the diseases of childhood, rheumatism, malaria, influenza, pleurisy, and hemorrhoids. He had experienced heartburn. Recently he had been suffering from continuous headache, malaise, vertigo, and weakness. There was no family history of rheumatism, of heart, lung, or kidney disease, or of dropsy.

About a week before admission the patient had been thoroughly drenched about the legs and feet, and since then he had had general pains, and also severe pain in the breast, especially on the left side, so that he was unable to stoop on that side. He complained of dyspnea and palpitation on the least exertion, but never otherwise. He was

weak and unable to work.

The patient was an exceedingly well-developed and strong-looking A small swelling, adherent to the bone, but not to the skin, was present over the right frontal bone. His right cye had been "picked out by a crane," but the pupil of his left eye reacted normally. tongue was coated and flabby. The pulse was 76, regular, fairly strong, of high tension, and compressible. The radials were somewhat thickened, but the temporals were not.

The breathing was of the abdominal type; the chest did not move. On forced respiration expansion was diminished. Pulsation was noted in the vessels of the neck, but not in the epigastrium. A diffuse retraction was seen in the sixth interspace in the neighborhood and to the

left of the mid-clavicular line.

The heart was slightly enlarged. The cardiac sounds were fair, but not of good quality. They were heard best in the sixth interspace, just outside of the mid-clavicular line. During the whole of systole a peculiar brushing sound was heard over an irregular arca, bounded: above, by the fifth rib; below, by the seventh costal cartilage; on the right, by a line an eighth of an inch to the left of the right sternal border and by the left costal margin; and on the left by a line one inch to the right of the mid clavicular line. The sound did not seem to be superficial. It apparently did not accompany the second sound of the heart. It was not affected by respiration nor by the holding of the breath, at the end either of inspiration or expiration. When the patient leaned forward the sound was heard louder and over a larger area, extended farther to the right, to the left, and below. The sound was not much affected by decubitus, but it might have become a little less loud, and the area might have become slightly diminished in size. The sound was intensified by exercise.

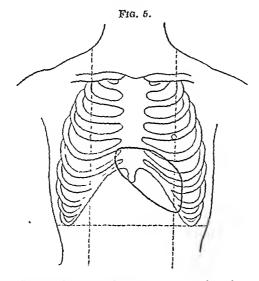
The lungs were apparently normal.

The abdomen was normal. The liver and spleen were not enlarged.

The legs exhibited no ædema.

The blood contained 94 per cent. of hæmoglobin and 4,700,000 red blood cells. The coagulation time was two minutes.

The patient improved under potassium iodide in increasing doses.



The xiphosternal sound at a subsequent examination was described as

"a peculiar, gentle, rubbing sound."

CASE VI.—J. F. O. B., white, aged forty-two years, married, a leverman, was admitted on November 14, 1902, complaining chiefly of the fact that he caught cold easily.

The patient's mother had rheumatism, and one brother had died of

dropsy.

The patient had had mensles, chicken pox, urticaria, gonorrhea, syphilis, malaria, lumbago, influenza, and eczema. For some years he had suffered from periodic headaches, occasional vertigo, winter cough, sore-throat and dyspnea, and palpitation on exertion. He also experienced dyspeptic symptoms. He had aches and pains all over occasionally, especially six years ago. He had had lumbago several times.

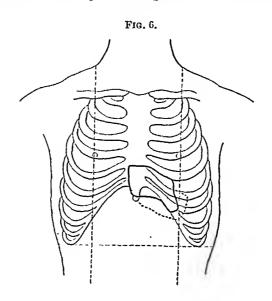
The patient came referred from the throat and nose dispensary, say-

The patient came referred from the throat and nose dispensary, saying that he caught cold easily. He suffered from itching about the rectum and from occasional epigastric pain and tenderness. He complained of weakness and of becoming easily tired. He said he had a fissure.

The patient was a thin, poorly-nourished man. His pupils were equal and reacted normally. His tongue was fairly clean, but rougheucd, furrowed, and slightly tremulous. His pulse was 92, regular, weak,

and of fair tension. The radials were slightly fibrous.

The chest was emaciated and flat, and presented some capillary congestion. The superficial veins were dilated. The left scapula was prominent. Above and below the clavicles there were depressions on the right and some fulness on the left. The neck inclined to the right. There was a slight retraction in the sixth and seventh interspaces about the mid-clavicular line; also in the tenth and eleventh interspaces, in the region of the posterior axillary line and nearer the spine. A retraction during systole was noted between the ensiform and the left costal border, seen during inspiration—best at the end—and scarcely visible during expiration. Expansion was poor, being much restricted on the left.



The apex beat was neither visible nor palpable. The heart was enlarged to the left. The cardiac sounds were heard best in the sixth interspace, in the mid-clavicular line. The sounds were very weak and or poor quality at the apex; scarcely audible at the aortic cartilage, the first being particularly indistinct; also weak but somewhat louder at the pulmonary area, and louder still at the ensiform. A rubbing, harsh sound was heard to the left of the ensiform over a small area the size of a quarter, bounded roughly by the fifth rib above, the left border of the sternum and the left costal margin on the right, the mid-clavicular line on the left, and by the junction of the seventh rib with the costal margin below. The sound was very indistinct; sometimes louder at one time during a fifteen-minute examination than at another, and often not At times it seemed to become louder when the patient leaned forward, but often it seemed little if at all affected by this position. did not seem to be affected by pressure with the stethoscope. When the patient lay down this sound was not heard, and all the cardiac sounds were weaker. At times the sound was heard best during inspiration, sometimes just at the end, the breath being held; at other times at the end of expiration. It seemed to be heard hetter during the expiratory

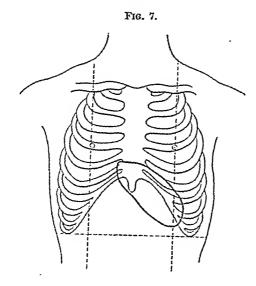
oftener than during the inspiratory act. The boundaries of the area were not very distinct. At no time was the sound very loud, and at the borders of the area at times it seemed to blend with the impure heart sounds heard over the præcordia. The sound accompanied the systole of the cardiac cycle. Exercise did not increase the loudness of this sound, but did increase the loudness of the ordinary heart sounds. No sounds were heard in the vessels of the neck.

There was dulness at the apex of the left lung anteriorly, and over the right chest posteriorly. The breath sounds were very faint. Expiration was possibly slightly prolonged on the right posteriorly. There

were a few coarse râles on the right posteriorly.

Examination of the abdomen was negative. The outline of the stomach was as in the diagram. Two fistulæ in ano were present. The veins of the arms were distended.

Station and gait were both good. The patellar reflexes were normal. The plantar reflex was normal on the left, but very slight on the right.



No tubercle bacilli were found in the sputum.

The urine was of specific gravity 1010, acid, and contained no albumin or sugar.

The blood contained 80 per cent. of hæmoglobin, 4,800,000 red blood cells, and 5840 leucocytes. The congulation time was between two and

two and one-quarter minutes.

The stomach contents were extracted after a hearty meal. (The patient did not state that he had not taken the test breakfast ordered.) They were greenish-yellow in color, and contained undigested particles. The reaction was acid. No free acids were present; 0.4 c.c. of a decinormal solution of sodium hydrate neutralized 2 c.c. of the filtrate (or 20 c.c. neutralized 100 c.c.). There was no free hydrochloric acid and no lactic acid.

The only treatment given was a thirtieth of a grain of strychnine sulphate three times a day, the patient improving and feeling better than

he had for years.

The xiphosternal sound was called, on November 24th, a "scraping

sound" and a "brushing sound;" on December 1st, a "peculiar sound;" and on January 6, 1903, a "crunching sound." On this last day the sound was not so distinct; at times it could not be heard, and the area over which it was heard was smaller than before.

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THE CELLULAR CHANGES IN TUBERCULOUS LEPTO-MENINGITIS.*

BY I. B. DIAMOND, M.D., ASSISTANT IN MEDICINE, RUSH MEDICAL COLLEGE.

(From the Pathological Laboratory of Rush Medical College, Chlcago.)

In view of the interest attached in recent years to the presence of plasma cells and phagocytic endothelial cells and their relation to certain acute infectious inflammations, and since finding similar cells in acute tuberculous leptomeningitis, I have made, at the suggestion of Prof. Hektoen, a histological examination of the tissues at hand in this laboratory, in order to determine, if possible, their rôle in this form of tuberculous inflammation.

The tissues examined are from four eases, three acute and one chronic. Sections, fixed in alcohol and in Zenker's fluid, were stained in Unna's polychrome methylene blue, preceded by eosin, as recommended by Mallory; some were stained in thionin, and others in Harris' carboltoluidin blue. Clear pictures were obtained with all of these methods.

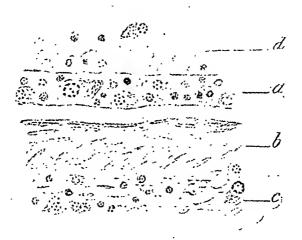
The cellular changes in acute tuberculous leptomeningitis will first

^{*} Presented before the Chicago Pathological Society, May 13, 1901.

be described. These may be summarized as follows: Plasma cells together with lymphoid and phagocytic cells form the greater portion of the cell-infiltrations in the vascular and extravascular areas of the leptomeninx.

The most important of the vascular changes, as shown by Hektoen, is a tuberculous endarteritis, affecting the medium-sized and smaller arteries, characterized by the formation of intimal tubercles and a diffuse, subendothelial intimal proliferation. Examination of such arteries shows the following: The earliest cell change consist in the accumulation underneath the endothelium of the intima of plasma and lymphoid cells, with an occasional polymorphonuclear leucocyte (Fig. 1, a). The plasma cells do not differ materially from those



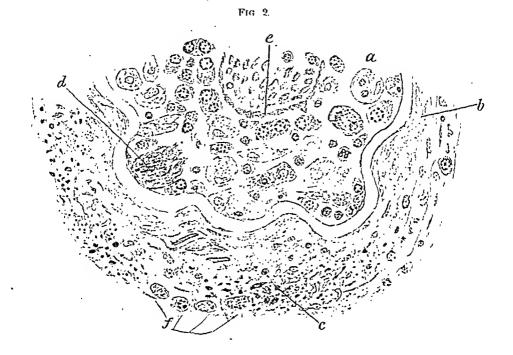


a, collection of plasma and lymphoid cells underneath the endothelium of a small artery; b, media; c, adventitia, containing a few plasma and lymphoid cells; d, lumen of vessel. Easin and polychrom methylene blue. Oil lm. 1/12, oc. iv. (Diamond.)

described by Councilman² in acute interstitial nephritis. They may be round or oval in shape and vary considerably in size. Nuclear figures are frequently seen (Figs. 1 and 2, α). There is usually but one nucleus in a cell, situated eccentrically, but occasionally there are two and rarely three or four in a cell. In the round or young plasma cell the nucleus is usually in the centre. While many of the plasma cells proliferate by mitosis, others, again, seem to be derived from lymphoid cells, as they appear to have the characteristics belonging to both cells.

At first the plasma and lymphoid cells emigrate from the blood or from the lymph spaces of the arterial adventitia, and then find their way underneath the endothelium. On the one hand, passing directly through the endothelial layer, while, on the other, penetrating the elastic layer. This was especially marked in one of the cases, the tissues of which had been well preserved. Here many plasma and lymphoid cells were seen in the act of passing through the elastic cont from the perivascular lymph spaces into the intima. They were very irregular in shape, many of them elongated, lying, as it were, across the elastic coat, part of their cell body and nucleus being in the intima and part in the media.

In the more advanced stage other cells are found mixed with the plasma and lymphoid cells, namely, the subendothelial epithelioid cells. These proliferate from the subendothelial intimal connective



a, collections (underneath the endothelium) of plasma, lymphoid and subendothelial intimal connective tissue cells, also a giant cell at a. A few of the cells contain inclusions. Note the karyokinetic figure in the plasma cell; b, media; c, adventitia, showing cascation; f, four shrunken phagoeytes; c, swollen endothelium. Eosin and polychrom methylene blue. Oll im. 1/c, oc. iv. (Diamond.)

tissue, next to the elastic coat (Fig. 2, a). They are large, irregular eells, with granular and vacuolated cytoplasm, and usually eccentrically arranged vesicular nuclei. Mitotic figures are occasionally seen. Under an oil immersion they resemble epithelial cells, and are to a certain degree phagocytic, incorporating plasma and lymphoid eells and occasionally polynuclear leucocytes. These cells may form giant cells (Fig. 2, d), and in this manner characteristic intimal tubercles develop.

At this stage the endothelium, which is intact and only lifted up by the eollection of these various cells, may now become disarranged and may also show other changes, especially when there is hyaline degeneration or caseation, either of the proliferated cells or of the outer coats of the vessel wall. The individual cells may be swollen and irregular and their nuclei vesicular (Fig. 2, e). Proliferation is rarely, if ever, seen in the endothelium lining the arteries and veins, but may be found to a marked degree in those lining the capillaries and lymph spaces of the pia. Nuclear figures are frequently seen in the endothelium of such capillaries (Fig. 3, a). The newly proliferated endothelial cells possess marked phagocytic properties. They are found within the bloodvessels, especially in the capillaries (Fig. 3, b) and lymph spaces, in the exudates and throughout the surrounding tissue, where they are very numerous. The cell inclusions consist mostly of lymphoid and plasma cells, and as many as twelve may be present





Small capillary: a, nuclear figures in the endothelium, the one to the right is free in the lumen of the vessel; b, endothelial phagocytes; c, collections of plasma and lymphoid cells. Eosin and polychrom methylene blue. Oil im. 1/12, oe. iv. (Diamond.)

within a single phagocyte. These phagocytic endothelial cells are in every respect similar in appearance with those described by Mallory³ in typhoid fever.

Plasma and lymphoid cells are also found in considerable numbers in the adventitia of the arteries. In some places they form distinct collections. In the collections, and especially surrounding them, are found many phagocytic endothelial cells and a few leucocytes. Many of the phagocytes contain inclusions of lymphoid and plasma cells. Changes in the intima may or may not be present. Some arteries show caseation of the adventitia with recent cell changes in the intima (Fig. 2). The phagocytic cells which are found in and around such caseated areas are reduced in size, considerably shrunken, and their inclusions are broken up into small fragments (Fig. 2, f) while the plasma cells appear as indistinct rings or may resemble epithelioid cells.

In the early stages, when there are no evidences of caseation, the most numerous cells found in the capillaries and lymph spaces, as shown in Fig. 3, are the plasma and lymphoid cells. From here they evidently pass out into the surrounding tissue, where they form the greater part of the cellular infiltration. They are found collected in masses at the sides of the vessel walls, and in some places are so numerous as to cover up entirely the endothelium of the capillaries.

Similar appearances are to be found in the walls of the smaller veins. These are extensively infiltrated with plasma and lymphoid cells. In some areas the collection of cells is so great that the walls are completely covered. When the infiltration is circumscribed there is formed the so-called "lymphoid tubercle," composed, however, of both lymphoid and plasma cells.

Examination of the extravascular areas, the tissue between the blood-vessels and in the interstices of the loosely arranged connective tissue fibres, shows considerable fibrin, in the meshes of which are entangled plasma and lymphoid cells, large phagocytic endothelial eells, and a few leucocytes. Later all these areas may undergo extensive cascation, which even involves the adventitia of the arteries. The latter are then usually thrombosed.

The subjacent cortex is also infiltrated with plasma and lymphoid cells, while the perivascular lymph spaces of the capillaries in the cortex are always distended with plasma cells. Plasma cells are also found in the capillaries of the cortex.

The foregoing is a brief description of the cellular changes found in acute tuberculous leptomeningitis. Of especial interest are the great production of plasma cells and to a less degree of phagocytic cells. So far as I know, plasma cells have never been described in acute tuberculous inflammations. It will be seen, however, from the foregoing that the plasma cells play here an important rôle, the cell changes being analogous to a marked degree with those described by Councilman² and Pearce⁴ as occurring in searlet fever. Not less interesting is the production of the phagocytic cells. Although less marked it is analogous, on the other hand, to the proliferations described by Mallory³ as occurring in typhoid fever. In a recent article on proliferation and phagocytosis, Mallory⁵ also describes the proliferation of phagocytic cells in the meninges in a case of tuberculous meningitis.

An interesting question is the origin of the phagoeytes. Mallory believes that in tuberculosis the proliferated connective tissue cells become phagocytic. This, I believe, is true to a certain extent in tuberculous leptomeningitis. Especially those cells which proliferate from the subendothelial connective tissue of the arterics. It is difficult, however, to determine whether a given phagocyte is of connective

tissue or endothelial origin, for the reason that they cannot be distinguished morphologically, after they become phagocytic.

The process of phagocytosis as first described by Mallory is not yet universally recognized. And various interpretations are given to these cells when they are met with. A case in point is a recent article by Turner⁶ on the destruction of nerve cells. Here he illustrates various large cells from the meninges in suppurative meningitis. On page 82 he says: "In cases where recent lymph is found in the meninges, the nuclei segment, and sometimes daughter cells, are seen within the large multinucleated corpuscles which appear to be ultimately extruded, leaving empty spaces in the parent corpuscle." These cells, from the drawings, appear to be nothing else than phagocytes with cell inclusions.

I have since examined, through the kindness of Prof. Hektoen, all his mounted slides of tuberculous meningitis, and have invariably found in these sections phagocytic cells. In some sections they are the most numerous cells present in the extravascular areas. In his article Dr. Hektoen frequently describes them as large cells and as multinucleated giant cells. Plasma cells were also found quite numerous, but difficult to recognize in these preparations. This is especially true with the cells found underneath the endothelium, for they (plasma cells) closely resemble (hæmatoxylin and eosin preparations) the subendothelial intimal connective tissue cells.

Since Mallory⁵ describes an instance of the presence of bacteria in phagocytic endothelial cells, I may mention the fact that the large round cells containing tubercle bacilli, and which are described by Dr. Hektoen in the smear preparations from Case V., are also phagocytes. Many of them contain cell inclusions of lymphoid cells. From this it seems probable that phagocytes must also be reckoned with as a factor in the transmission of tubercle bacilli from one area to another in tuberculous meningitis.

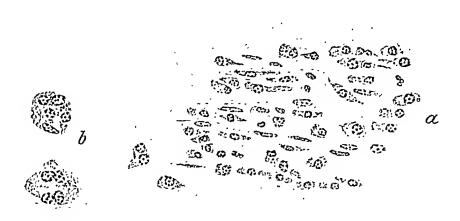
The fate of the plasma cells is another interesting question. In acute tuberculous meningitis the majority naturally soon break down and die as a result of cascation. Therefore the tissue from a case of (chronic) healing tuberculous meningitis was studied.* As might be expected, plasma cells were found in great numbers; in fact, they make up the bulk of the proliferated cells. Sections stained with cosin and polychrom methylene blue show, on examination, a pinkish, loosely fibrillated, homogeneous matrix of collagenous tissue in which are embedded mostly plasma cells (Fig. 4). These are mostly elongated and spindle-shaped, and contain usually but one nucleus. Nuclear figures are not seen. Many of the irregular or squarish plasma cells

^{*} This case was described by Dr. Hektoen with reference to the fate of the giant cells in healing tuberculous meningitis. Journal of Experimental Medicine, 1898, vol. iii., No. 1.

eontain two to four nuclei. Giant cells are frequently seen, containing from four to eight nuclei (Fig. 4, b). These evidently multiply by indirect division, as many of the cells contain constricted or kidney-shaped nuclei, similar in appearance to those described by Krompecher.

A certain number of the plasma cells show various degenerative changes, which are similar to those described by Schottländer and Krompecher. These are the transformation of plasma cells into epithelioid cells, hyaline degeneration—round homogeneous violet-stained bodies within the plasma cells—and vacuolations. The majority, however, are undergoing progressive change, namely, changing into connective tissue cells. This, I believe, is evident from the character of the tissue—granulation tissue—and from the appearances of the plasma cells themselves. Transition stages between the two cells are





a, plasma cells resembling connective tissue cells; b, giant plasma cells. From (chronic) healing tuberculous meningitis. Eosin and polychrom methylene blue. Oil im. $\frac{1}{12}$, oc. iv. (Diamond.)

frequently seen. As the cells elongate and become spindle-shaped the perinuclear spaces in the plasma cells become larger, while the granular cytoplasm is heaped up in clumps peripherally in the cells. Harris interprets these appearances of the plasma cells to a secretion of fibrous tissue instead of a direct transformation of the cells into connective tissue.

A very interesting question is: Are all the plasma cells in this tissue derived from lymphoid cells and mononuclear leucocytes, or are part of them of connective tissue origin? as Joanovicas? claims, and that only those derived from connective tissue cells are able to form new connective tissue. This question must remain unauswered. It will be seen, however, that the plasma cells in acute tuberculous inflammation differ somewhat from those present in the chronic form.

Although conclusively shown by most observers that plasma cells are derived from lymphocytes, opinions still vary. Recently Herbert¹⁰ makes the statement that lymphocytes are young plasma cells—daughter plasma cells—while the plasma cells are derivatives of the fixed connective tissue cells. Comment, however, is unnecessary.

In conclusion, I wish to express my thanks to Prof. Hektoen for kind advice during the course of this investigation and also for the use of his microscopic slides.

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A CASE OF PARALYSIS OF THE SIXTH AND SEVENTH CRANIAL NERVES OF THE RIGHT SIDE WITH HEMIPLEGIA OF THE OPPOSITE SIDE.

BY E. ANDRADE, M.D.,

EX-ASSISTANT TO THE OPHTHALMIC CLINIC OF THE UNIVERSITY OF GENOA (ITALY).

THE study of the paralysis of the motor nerves of the eye is very important, not only on account of the alarm which they produce in the patient, the æsthetic effect and the visual disturbances, but especially by reason of their often being the first symptoms of serious central disorders. Since the ocular nerves have circumscribed nuclear origin and a well-known course, the alterations of their function very often allow the definite localization of the lesion. If at the same time other paralyses are present the point where the pathological process is located can be determined even more accurately.

One of the most frequent paralyses of the motor nerves of the eye is that of the third nerve, its presence being a very important sign in many nervous diseases. In certain cerebral disorders, paralysis of the oculomotor, especially of those branches that supply the exterior muscles of the eyeball, is accompanied by hemiplegia of the opposite side, and this complex symptom called Weber's syndrome, is a positive indication of a lesion of the inferior part of the cerebral peduneles, or of the neighboring portion of the pons, on the same side of the ocular paralysis. The knowledge of the course followed by the oculomotor from its origin in the several cellular groupings on the floor of the aqueduct of Sylvius to its exit on the inner side of the cerebral peduneles, near the apex of the interpeduncular space, will easily explain this localization.

But besides Weber's syndrome there are other crossed paralyses which permit the locating of pathological processes at different points of the pons, as will be seen in the following case which I have had occasion to study during some time:

Clinical History. M. B., colored girl, aged ten years. Father contracted syphilis two years before her birth; mother has had six misearriages, two before and two after the birth of the child. The girl was born with the skin of the hands and feet macerated, the mother saying that they looked as if she had on white gloves and stockings, but otherwise she seemed to be in good health until two years ago, when symptoms made their appearance which compelled her to consult an oculist.

It was then observed that her right eye was strongly turned in—internal squint. The oeulist who saw her performed two operations on her eyes (tenotomy and advancement?) without any good result. A few days after the last operation, which took place in November, 1901, it could be plainly seen that the left arm and leg were weak, having lost most of the strength necessary to perform the usual movements, and that the left

labial commissure was drawn up when the child smiled.

In the last three months the patient has been afflieted with attacks of vomiting and vertigo three or four times, the vertigo being so strong as to cause her to fall down. Headache, s metimes of a violent character, is a constant and annoying symptom. The child has progressively lost her vivacity and is now in a noticeable condition of mental depression.

The eye fundi were normal at a first examination, but twenty days later there was congestion of the disks with dilatation of the venous vessels and prominence of the papillæ, all more marked in the right eye. The pupillary diameters and reactions show no deviation from normal.

Studying the movements of the eyeball, it is seen that the right external rectus muscle is completely paralyzed. When the eyes are directed toward the right side, the centre of the right cornea does not pass beyond the middle point of the inferior lid. All the other muscles work regularly, but in extreme lateral positions of both eyes a marked horizontal nystagmus is present. There are no associated paralyses of the movements of the eyes (Blicklähmungen). There is homonymous diplopia, especially when the eyes are directed toward objects situated on the right side of the patient. Olfaction, taste, and hearing are normal. Pharyngeal sensibility is decreased somewhat.

The left arm and leg are paralyzed, but they can with difficulty

The left arm and leg are paralyzed, but they can with difficulty perform some movements. There is no anæsthesia or analgesia and thermal sensibility is not altered. There are no contractions. The knee-

jerk is enfeebled; all other reflexes are normal.

The right facial nerve is paralyzed, but only in its inferior portion, the frontalis and orbicularis muscles showing no functional disturbance. No deviation of the tongue can be detected, which proves that the

fibres of the hypoglossus are not affected. Though the child answers intelligently all questions put to her, there is a condition of mental apathy.

The foregoing symptoms, I believe, are caused by a syphilitic gumma

situated in the inferior region of the pons on the right side.

The complex symptom just described in the preceding clinical history is characterized by the paralysis of the external rectus and facial nerves on one side and hemiplegia of the opposite side. In some other cases that have been reported there was besides paralysis of the hypoglossus and of the motor portion of the trigeminus; and sometimes, instead of hemiplegia, there has been tremor or hemianæsthesia. All these cases are forms of what is called Millard-Gubler's syndrome, which consists essentially in facial paralysis, more or less complete, with hemiplegia of the opposite side (crossed paralysis), and which is considered one of the most constant manifestations of disease of the pons.

In order to understand the reasons which have prompted me to localize the pathological process in the inferior region of the pons, on the same side of the ocular paralysis, it is necessary to remember the origin and course of the nerves which are supposed to be involved in the lesion.

The sixth nerve originates in a nucleus situated in the floor of the fourth ventricle surrounded by the radicular fibres of the facial, the nucleus of which is located more deeply in the floor of the same ventricle. From its origin the fibres of the abducens united in three or four bundles take a dorsoventral course parallel to the median raphé. They continue through the trapezium and peduncular fibres to appear as a single trunk at the base of the brain in the groove between the anterior pyramid and the inferior border of the pons. The radicular fibres of the facial nerves after leaving their nucleus ascend loosely connected toward the median line, forming the ascending branch of the root of the facial, and turning forward they cover the dorsolateral aspect of the abducens nucleus. At this point the facial reaches very near thefloor of the ventricle, where it produces an elevation—tuberculum nervi facialis.

The facial fibres are then directed downward, passing before the anterior end of the nucleus of the sixth nerve (descending branch of the root of the facial), and farther down between their own nucleus of origin and the sensitive root of the trigeminus. They make their exit at the base of the brain in the lateral part of the groove between the medulla and the pons.

Though the relation between the nuclei and radicular fibres of the sixth and seventh nerves are very intimate, recent investigations have failed to support Meynert's contention, which states that many fibres of the facial, those which supply the frontalis and orbicularis muscles, have their origin in the abducens nucleus. In fact, it has been demonstrated

that in cases of complete rupture of the facial nerve in the aqueductus Fallopii, none of the cells of the nucleus of the sixth nerve have shown any secondary degeneration. According to the majority of the investigators, however, the abducens nucleus sends to the oculomotor of the opposite side fibres which supply the internal rectus in the lateral associated movements of the eyes.

This anatomical description explains without any difficulty why a lesion of the pons at its inferior region, where the fibres of the sixth and seventh nerves come into relation with the peduncular fibres that cross lower down at the decussation of the pyramids to supply the opposite side of the body, would cause all the symptoms met in the case just reported. I do not believe that the pathological process affects the nuclei, because there is no paralysis of the associated movements of the internal rectus of the opposite side, as would be the case if the nucleus of the sixth nerve were diseased.

The limitation of the facial paralysis to the inferior portion of the territory supplied by the seventh nerve without involvement of the frontalis and orbicularis muscles does not necessarily indicate a nuclear lesion, because the fibres of the facial while going through the pons are very loosely connected and it may easily happen that a lesion destroys only those which supply the inferior territory.

In regard to the nature of the lesion, the family history makes it very likely that we have to deal with a syphilitic gumma.

Hereditary syphilis, it is well known, can produce this pathological change in the nervous system. In spite of certain symptomatic differences, more apparent than real, between hereditary and acquired syphilis, the pathological process is the same, an accumulation of cells that causes arteritis, thickening of the nerve sheaths, or a gumma.

The slow and progressive course of the disease compels us to discard the idea of a hemorrhage due to syphilitic endarteritis. The increased congestion of the optic disks during the preceding week points to an extension of the granuloma. Notwithstanding all that has been said in favor of a syphilitic lesion, it is not wise to exclude entirely the possibility of a tubercle of the meninges of the base of the brain, that, pressing on the pons in the region of the sixth and seventh nerves, and destroying the corresponding fibres, would produce all the symptoms just described. Hereditary syphilis does not exclude tuberculous men-In this case, however, the paralysis of the facial nerve would be complete, affecting all the muscles supplied by it, including the frontalis and orbicularis. The result of the energetic antisyphilitic treatment to which the patient has been submitted will help, no doubt, to clear the etiology of the disease, but we must remember that cerebral syphilis in an advanced stage does not always respond to antisyphilitic measures.

HICCOUGH. REPORT OF A CASE.

By L. W. Atlee, M.D., of Philadelphia.

A COMPLETE study of hiccough from a physiological and pathological point of view remains yet to be made. From a clinical standpoint this is much more worked out. Historically the subject is one of great interest, as it has been observed and commented on among our earliest medical writings; in fact, the bibliography is very voluminous, and though of use to those whose tastes lead them into such investigations, they will reward us with little of practical value, as the observers were more led by theoretical ideas than by observation of facts—a reproach, indeed, from which modern medicine cannot by any means escape.

R. M., American, aged seventy-nine years, a large, well-nourished old man. One week ago he began to hiccough; he could attribute no When first observed during the earlier three days there would be intervals when the condition ceased entirely, but for the past four days he complains that he has hiccoughed uninterruptedly night and day. At first he had lived on his ordinary meals and diet, but later this had caused vomiting in addition to the already existing hiccough, and for the past couple of days he had taken nothing but tea and crackers. When first seen—on the eighth day—his countenance bore a very anxious expression. The color of the skin and mucosa suggested cyanosis from defective aëration of the blood due to the inefficient respiratory efforts. The tongue was coated with a thick, white, pasty fur; his bowels had not moved for the past four days. Examination of the thoracic organs revealed nothing abnormal beyond some emphysema, so common in stout, aged people. The heart was large, but no murmurs could be detected. Examination of the abdomen showed nothing excepting double inguinal hernia. These were large and descended well into the scrotum. They were easily reduced and retained by compresses and a spica bandage of the groin. In fact, this was done immediately on their discovery, as such a condition was very suggestive as a causative factor of the vomiting, hiccough, and constipation, though there was no abdominal distention; but the replacement of the herniæ produced no amelioration of the symptoms.

The medical treatment was begun by the time-honored giving of a large calomel and soda purge. A mustard plaster was applied to the epigastric and left hypochondriac regions (a very large one), and kept on as long as it could be borne. After the calomel had acted well, he was given a mixture containing bismuth subnitrate, dilute nitric acid, and spirits of chloroform in compound tincture of cardamom; this was to be given every hour while the hiccough lasted, and to be repeated should it return. The diet, which had hitherto been restricted in no way, was to be limited to the white of an egg stirred up in six ounces of cool water, alternating this every other feeding with clam-broth or juice. (The best and simplest manner of obtaining this is by heating six large, well-cleaned clams, unopened, in a pot; as soon as they open

the juice is strained off; if too salt, it can be diluted with a few table-

spoonfuls of water.)

After the fourth dose of the mixture and pretty severe counterirritation by the mustard plaster, the hiccough ceased, and did not recur for three hours, when it was again controlled by the mixture, so that he passed a whole night without any hiccough. The following morning, unfortunately, it began again at an early hour more severely than ever. A repetition of the former treatment being unsuccessful, he was given twenty grains of chloral by the mouth. In the course of ten minutes it began to exert its well-known power to stop such spasmodic movements, and in half an hour the hiccough had entirely ceased. This interval lasted eight hours, when a second dose of the same size was given, almost immediately controlling the spasmodic movements. Subsequently the chloral had to be repeated twice, when the tendency to a recurrence of the hiccough ceased.

It is now some three months since this case was under observation,

and the old man is enjoying his usual extraordinary good health.

In old or enfeebled persons hiceough can be the direct cause of death, which is attributable to the effects of the long continuance of the diaphragmatic choreic spasms on the performance of vital functions. This is markedly seen in its action on respiration, causing deficient aëration of the blood. As the disease is usually aggravated by the ingestion of food, the patient will soon begin to suffer from the deprivation of needed sustenance. Again, it is impossible to sleep owing to the violent sudden commotions given to the whole body at each spasmodic descent of the diaphragm.

The aets which take place and occur in succession to produce the phenomenon of hiecough are contraction of the diaphragm, convulsive agitation of the abdomen and thorax, vibration of the glottis producing a characteristic sound. The contraction of the diaphragm is the initial act; it is brisk, spasmodic, and involuntary, and consists in tension of its mass and its descent, and has for its effect the crowding of the contents of the upper abdomen. The respiratory movement determines a rush of air through the respiratory tract, which is sudden and violent. This column of air coming in contact with a flaceid glottic orifice produces the accompanying sound, as the normal glottic dilatation of inspiration does not take place. These phenomena repeat themselves many times.

All the muscular phenomena which go to make up the respiratory act are innervated in the centre for this movement in the medulla, but being as it is a most complex act, there are a great variety of central, intermediary, and peripheral places where stimuli may produce disorder of the proper concensus of the muscular actions.

Direct irritating lesions of the respiratory centre, either inflammatory or from neoplasms, have been accompanied by hiccough as a symptom. The hiccough seen during the infectious diseases, or in

defective elimination of physiological products, can be viewed as of central origin, due to the effect of poisons circulating in the central nervous system. As an example of hiccough from the effect of toxic agents, may be mentioned the *hoquet tobagique*, of the French, due to tobacco poisoning.

Any irritation of the phrenic nerve from its origin in the cervical plexus, or of its fibres in the cervical cord, may cause this phenomenon, as it has been observed in transverse myelitis of this region, associated with slow pulse, dysphagia, dysphoea, and myosis. It has also been observed during the course of neuralgia of the branches of this plexus (probably a neuritis). Direct irritation of the phrenic nerve by tumors of the mediastinum, aneurisms, pneumonia, and pleuritic effusions (if the mediastinal pleura is involved), may cause hiccough. The same may be said of the nerve in its course before entering the mediastinum, where it may be irritated by enlarged glands, abscess, tumors, or aneurisms.¹

The frequent occurrence of hiccough during the course of diaphragmatic pleurisy has led Geuneau de Mussy to regard it as being caused by a neuritis of the terminal filaments of the phrenic nerve. Though it has not been observed as an unfailing accompaniment of this disease, it has been seen frequently enough to make it suggestive of this condition.

Since hiccough is (in by far the greatest number of cases) caused by abdominal derangements, we must agree with Gowers' "that the curious phenomena of hiccough may be connected with affections of this nerve (pneumogastric), as they certainly are with the respiratory centre." Perhaps the most common cause of hiccough is an overfull stomach; and next most frequent, distention of the stomach with "wind," or, as Hippocrates puts it, "Convulsio fit aut a repletione, aut ab evacuone, sic etiam singultus." In many people the ingestion on an empty stomach of hot drink or food will bring on a paroxysm, as will also brandy, liqueurs, or food highly seasoned with red pepper, and such like condiments. It is met with in all forms of stomach disease accompanied by digestive difficulties, catarrhal, ulcer, cancer, and gastralgia. "The existence of hiccough is a sign of some value in cancer of the stomach when the question arises in cases where the growth cannot be palpated, as it is a not infrequent symptom of cancer of the cardiac region or vicinity."

All forms of irritation or inflammation of the intestinal mucosa are frequently attended with hiccough, indigestion, worms, dysentery, etc.

¹ Rosenthal. Diseases of the Nervous System, vol. ii. p. 225.

² Diseases of the Nervous System, vol. ii. p. 295.

³ Dict. Ency. des Sci. Med., T. xiv. p. 425.

Irritation and inflammation of the liver and its gall-bladder or ducts are also among the frequently observed causes of hiccough. Any cause of obstruction to the onward movement of the intestinal contents is usually accompanied by this affection, as in paralysis of the intestinal walls, or in obstruction of the continuity of the intestinal tube by its contents, or from causes outside the tube in the form of bands, neoplasms, etc., or by volvulus, intussusception, strangulated hernia, etc. It is common during the course of acute peritonitis, and from observation of it in this disease and during the course of intestinal obstruction among its terminal manifestations, Hippocrates regarded it as a sign of evil omen—"ex vomitione singultus, Malum."

Hiccough occurring during the course of typhoid fever or any ulcerative intestinal disease should suggest perforation of the intestine.¹ The disease is frequently observed in uramic states, and very often is among the terminal symptoms in genito-urinary infectious, as in the pyelonephritis arising from bladder infection in chronic cystitis due to prostatic obstruction. In the first, we are dealing with a hiccough of central origin due to the toxamic condition; in the latter, both peripheral and central causes can be factors in the hiccough.

Among the protean manifestations of that capricious neurosis—hysteria—hiccough is a not infrequent symptom, and may be regarded as of central origin. In this class may be placed those cases where the hiccough has followed fright or some violent emotion. Among the older writers on this subject instances are recorded where the hiccough was of several years' duration, a fatal result being averted by occasional cessations of the spasmodic movements. The application of the well-known physiological law of the tendency to repetition of accustomed movements will be suggested by the long continuance in these cases.

Owing to the great variety of conditions which may give rise to hiccough, the means found successful in its treatment has been of the most extreme diversity; but naturally its treatment consists in the removal (if possible) of the morbid condition giving rise to it. At the same time we may have to treat it entirely symptomatically, for, as we have previously stated, it may be productive of a condition in debilitated persons resulting in death.

In the simplest form, as seen, for instance, in infants, and due to overdistention of the stomach with food or wind, emesis or a carminative is indicated.

Occuring in adults and due to simple gastric irritation, large doses of bismuth subnitrate, perhaps combined with some aromatic substance, as the compound tineture of cardamom, and spirits of chloroform, will

¹ Quain's Dictionary of Medicine, article Hiccough.

be often successful. Small doses of dilute nitric acid added to these are seemingly useful also.

When a case proves rebellious to remedies directed only to the correction of the apparent cause of the hiccough, we may then resort to medicines of a purely antispasmodic character. Of these chloral has been found to be pre-eminently the most effective, and should be given in a full dose. As much as twenty grains can be repeated at hourly intervals until sixty grains have been taken. Should the hiccough still continue, it is probable the chloral will not be successful in larger and also, perhaps, dangerous doses. The bromides have not shown themselves so useful in the cases where gastric irritation was largely the factor in its production. In these cases it is of the greatest benefit to apply counterirritation to the epigastrium, for which a mustard plaster is usually the most readily found to hand. The diet in these cases is also of the first importance, and must be of the blandest description: albumin water, weak chicken tea, or clam juice or broth, until the gastric irritation has been allayed.

It would be to no purpose to enumerate the great variety of drugs that have been advised for hiccough. Among the many means recommended, however, several are worthy of mention as having been frequently successful. It has been known that the act of sneezing will break up the morbid train of phenomena that go to make up the act of hiccoughing. To provoke it, remedies called sternutatories were used. The easiest one of these to find is ordinary tobacco in the form of snuff.

As any violent emotion can produce hiccough, so it has also been known to stop it. Dupuytren cured a protracted case instantly by the application of the actual cautery to the epigastrium—a remedy, we doubt, would be submitted to by many.

Of mechanical measures, direct pressure on the phrenic nerves at the root of the neck, forced flexure of the head on the thorax, and deep, continuous pressure in the epigastrium are said to have caused a cessation of the spasm.

When hiccough arises in hysterical subjects, it is well to begin with the milder antispasmodics, such as valerian or the valerianates, passing on in case of non-success to more powerful drugs—chloral, apomorphia, or hyoscine hydrobromate. Counterirritation of the upper cervical spine, or of the epigastrium, ovarian pressure, and spraying the epigastrium with ether have all been successful, but usually fail when frequently repeated.

The hiccough due to sudden large losses of fluid from the body by hemorrhage, or in Asiatic cholera, is relieved by its restitution through the means of normal saline solution introduced in any of the various ways—entero, hypodermo, or venous.

CLINICAL GONORRHŒA WITHOUT THE GONOCOCCUS.

By A. L. BENEDICT, A.M., M.D., of buffalo.

While the existence of urcthritis, colpitis, and balanoposthitis not due to the gonococcus has been commonly admitted for a number of years, my attention has been directed to the matter by the paucity of actually reported cases. In a fairly systematic review of the world's literature for the past four years, I have thus far found only one note on the subject, namely, an article by Malherbe on "Staphylococcus Urethritis," in *Annales des Maladies des Organes Genito-urinaires*, November, 1901, abstracted in The American Journal of the Medical Sciences, March, 1902. Unquestionably, however, other articles must have appeared on this subject.

In several instances in which, for medico-legal, moral, or therapeutic purposes, discharges from little children have been submitted to me for examination, gonococci have been found without explanation of their source, and in apparently identical cases they have been absent. Of these cases I have no exact memoranda and the patients were not under my direct observation:

H. A. B., seen in 1889, presented the ordinary picture of acute gonorrhea, with free discharge. He denied having had gonorrhea in the past or of having had extramarital intercourse. His wife had some leucorrhea, according to his statement.

An unknown patient, 1901, presented a swollen and ædematous prepuce, phimotic, and with a sanious discharge from between the prepuce and the glans. The same discharge could be squeezed from the urcthra in small quantities, but appeared merely to have entered from without. He denied previous genorrhea or recent possibility of infection, except a single intercourse with his fiancé, whom he had every reason to suppose a virgin until that time. He was a man of refinement and was, naturally, much distressed.

Miss—, 1902, complained of acute cystitis, with pre-existing leucorrhea, for which she had used a clean syringe; the vesical symptoms
followed in a few days. The urethra was tender to the touch, and the
urine deposited a bulky, purulent mass. She claimed to be a virgin,
although the hymen was not palpable and the vagina was capacious.
For extramedical reasons, ocular examination, catheterization, and
definite localization of the source of discharge were not instituted.
The urine, however, after a vaginal douche, still contained an abundance of pus, and the clinical evidence of the joint involvement of the
bladder and urethra is ample.

None of these cases presented evidence of the presence of the gono-coccus, according to the ordinary Gram and decolorization tests. Indeed, by the simplest staining methods there was nothing to suggest the gonococcus, but the tests were, nevertheless, made. Various and numerous cocci, singly and in chains, and short and long, thread-like bacilli were present in all cases, but were not identified. All three cases yielded to treatment, consisting, respectively, of the ordinary syringing, local application of hydrogen peroxide, and use of urinary antiseptics. The first case was rather refractory.

In this connection may be reported the case of an intelligent Pole, who presented a peculiar, indurated and, in places, glossy glans, but no urethritis. Although married, he had not had intercourse for six months, and he denied venereal taint. His condition proved to be a mycosis, the fungus consisting of a mass of mycelia, without sporebearers. Neither myself nor Dr. Herbert Upham Williams could identify it exactly.

No apology is called for in regard to the first case, as I was then in general practice. The second patient was from out of town and was kept waiting until after ordinary office hours through a misunderstanding of his condition, which he referred, vaguely, to his abdomen. As his time was valuable, I undertook to make the preliminary examination and to refer him, if his disease proved to be gonorrhea. The third case was an intercurrent affection in an intestinal toxemia, with constipation and putrefaction in the bowel. While the syringe seems to have been the immediate carrier of infection, the case may ultimately have been due to the colon bacillus. The fourth patient was kindly referred to me by Dr. Lucien Howe, and suffered from gastric dilatation and catarrh. The scraping from the glans was examined as a matter of interest.

REVIEWS.

A SYSTEM OF CLINICAL MEDICINE, Etc. By THOMAS D. SAVILL. London: J. & A. Churchill, 1903.

THE plan of this work is quite original and deserves a detailed description. The Gordian knot of scientific classification is boldly cut by "considering convenience and practical utility rather than an appearance of scientific precision." Not that traditional lines have been altogether abandoned; in the main the elassification—the infectious fevers excepted—is by physiological systems, but the starting-point in the description of each disease is always a prominent group of symptoms eommon to a number of different pathological conditions, and not the title of any special disease. After all the possible eauses that might be responsible for the particular symptom group have been passed in review from the purely diagnostic standpoint, each disease is described systematically under the heads of diagnosis, prognosis, and treatment, with an oceasional reference to the pathology for purposes of clucidation. Theoretic discussion is avoided as much as possible. For example, after a short description of the general symptomatology of diseases of the abdomen and the methods of physical examination employed in that region, we find the diseases of the abdomen collected as "causes of abdominal pain" into two groups, the one entitled "Abdominal pain coming on suddenly with collapse," the other "Abdominal pain coming on suddenly without collapse," in both of which appendicitis figures. After this general division of the subject a series of special symptomgroups are detailed as: "The patient complains of acute abdominal pain which has come on suddenly, with symptoms of severe collapse, attended by vomiting and constipation. The pulse is rapid (over 100). case is probably one of three conditions: perforation into the peritoneum, acute peritonitis, or acute intestinal obstruction." And, finally, these three conditions are described in regular order, the introductory paragraph being slightly varied or amplified for each disease. This method obviously imitates the actual process of reasoning employed at the bedside and in office practice as closely as it is possible to reproduce a practical procedure in print, and has the great advantage of preserving the relative value of diseases, which is often lost sight of in systematic text-books. After the obvious and relatively frequent conditions have been fully treated, the rarer causes of the clinical picture under consideration are enumerated and briefly described, their lesser importance being reflected in the selection of smaller type.

It is true that the arrangement involves some repetition, for which the author apologizes in the introduction, and makes it somewhat more difficult to turn to the section treating of a given disease; but, on the other hand, the practical problems in diagnosis are presented as they are actually met in practice, and the student is taught to reason from effect to cause. It is an excellent way to enforce habits of observation and logical deduction, and to guard against the vice of establishing a pre-

conceived theory in making a diagnosis. The subject of treatment occupies a subordinate place in the scheme of the book, without, however, being altogether neglected; but the chief merit lies in the part

devoted to diagnosis.

The book is distinctly the author's own product. There is not much space devoted to historical details or the theories of his predecessors and contemporaries; it is, in fact, the result of his own observation and experience. This personal quality is most attractive and gives the work a stamp of originality at once distinguishing it from the usual run of text-books. One may not accept everything that the author says, and his peculiar method may not appeal to everyone, but some new light, at least, will be obtained on any perplexing problem for a solution of which the book is consulted.

R. M. G.

CANCER OF THE UTERUS. A Clinical Monograph on its Diagnosis and Treatment. With the After-results in Seventy-three Cases Treated by Radical Operation. By ARTHUR H. N. LEWERS, M.D. Lond.; F.R.C.P. Lond.; Obstetric Physician to the London Hospital, etc. With 51 original illustrations and 3 colored plates. 8vo., pp. 321. Philadelphia: P. Blakiston's Son & Co., 1902.

This excellent monograph is of great practical value from a clinical point of view, because it is an analysis of the writer's large experience in the treatment of uterine cancer. The illustrations are excellent, and the conclusions arrived at are in accord with the generally accepted views of the best authorities. The diagnoses in all of the cases operated upon were confirmed by the microscope, and the results obtained were interesting and suggestive. There were 33 high amputations of the cervix, with 18 per cent. cured; 28 vaginal hysterectomies for cancer of the cervix, with 14 per cent. cured, and 11 vaginal hysterectomies for carcinoma of the fundus, with 45 per cent. cured. Abdominal pan-hysterectomy is admitted to be the operation which offers the best chances of permanent cure. The writer pleads strongly for the early recognition of cancer, and dwells upon the importance and significance of the early symptoms. A careful study of this valuable contribution to the subject of cancer of the uterus will repay all who are interested in the matter.

J. B. S.

THERAPEUTICS OF INFANCY AND CHILDHOOD. By A. JACOBI, M.D., LL.D. Third edition. Philadelphia and London: J. B. Lippincott Co., 1903.

The third edition of Dr. Jacobi's well-known treatise shows evidence of careful revision and many additions made necessary to bring the matter up to date, but no actual changes in the general character of the book have been made. Radical changes, indeed, were not to be expected. The first edition presented the embodiment of the mature

judgment and unrivalled clinical observation of nearly a half century of active professional life, and in the two subsequent editions little need has been found to alter the opinions based upon so solid a foundation. In no portion of the volume is this fact more suggestively exemplified than in the portion devoted to infant feeding, in which his earlier teachings receive gratifying confirmation at this later date from some of his erstwhile most prominent critics and opponents.

The general scope and arrangement of the work are already too well known to need extended mention. Every page bears the stamp of Dr. Jacobi's individuality, which is often tinged with a degree of dogmatism that would sound rather strange from anyone else. This, indeed, is one of the charms of the book, for it gives to its teachings a touch of finality

that at once inspires confidence and challenges respect.

As a contribution to the practical therapeuties of infancy and child-hood, Dr. Jacobi's work as it now stands will long continue to occupy a unique and prominent place in pediatric literature. T. S. W.

THE AMERICAN TEXT-BOOK OF OBSTETRICS. FOR PRACTITIONERS AND STUDENTS. By James C. Cameron, M.D.; Edward P. Davis, M.D.; Robert L. Dickinson, M.D.; Henry J. Garrigues, M.D.; Barton Cooke Hirst, M.D.; Charles Jewett, M.D.; Howard A. Kelly, M.D.; Richard C. Norris, M.D.; Chauncey D. Palmer, M.D.; George A. Piersol, M.D.; Edward Reynolds, M.D.; Henry Schwarz, M.D.; J. Clarence Webster, M.D. Richard C. Norris, M.D., Editor, and Robert L. Dickinson, M.D., Art Editor. With nearly 900 illustrations. Second edition, revised. In two volumes. Philadelphia and London: W. B. Saunders & Co., 1902.

This splendid work is so well known that it needs no introduction. For convenience of handling it appears in two volumes, and in this edition there are evidences of careful revision. As an example of bookmaking, printing, illustrating, and editing, and from the standpoint of clear and concise teaching the book is unsurpassed by any work of the kind with which we are familiar.

J. B. S.

MUCOMEMBRANOUS ENTEROCOLITIS. By MAURICE DE LANGENHAGEN. London: J. & A. Churchill, 1903.

In this miniature volume, attractively bound in red, which may be read during a day's round of professional calls, the author gives his readers the benefit of an unusually concentrated experience of this not very common disease among the guests of a popular health resort which is his field of activity. Mucomembranous colitis is not a rare disease; or, at least, like many other conditions, it is now more frequently recognized, and thus appears to be on the increase; the author pleads for its more general recognition in ordinary medical manuals. Outside of France and Germany the disease has been studied a good deal by

American writers; indeed, the name "membranous enteritis" is a contribution from Da Costa. The subject is treated systematically in ten chapters, and the author apparently leaves little to be added. The question of treatment, which is very fully discussed in the last chapter, is an important one in this disease, which "can always be considerably relieved, and sometimes completely cured." It is, moreover, the part of the subject that appeals most to the general reader. There are three indications—to regulate the diet, provide for a daily evacuation of the bowels, and to relieve the pain and concomitant dyspeptic symptoms. The keynote in the choice of foods is the avoidance of fats and any articles that leave a large quantity of ash to irritate the bowel. Green vegetables, salads, and raw fruit are rigidly excluded from the diet list, as the author believes they are not only useless as laxatives, but absolutely harmful on account of their irritative properties. There should be no hesitation about the employment of medicinal laxatives, even daily, if necessary. The author himself prefers castor oil, but the patient's individual peculiarities must be consulted. The local treatment, consisting of high enteroclysis, is an essential feature, and the technique and pharmacology are fully given. R. M. G.

ANATOMY. A MANUAL FOR STUDENTS AND PRACTITIONERS. By WILLIAM H. ROCKWELL, Jr., M.D., formerly Assistant Demonstrator of Anatomy in the College of Physicians and Surgeons, Columbia University, New York. Series of Pocket Text-books, edited by Bern B. Gallaudet, M.D., Demonstrator of Anatomy and Instructor in Surgery, College of Physicians and Surgeons, Columbia University, New York; Visiting Surgeon, Bellevue Hospital, New York Illustrated with 70 engravings. Philadelphia and New York: Lea Brothers & Co.

THE author states in his preface that the object in writing this volume is to provide the student with a manual at once compact and fairly complete, and this, after a careful review of the book, it must be granted the author has accomplished. Gray's Anatomy has been followed as a standard, but it will be noticed in examining the work that repetition, which is so frequently met with in Gray, has been carefully avoided. It is a decided advantage to many who will use this book that Gray's Anatomy has been followed, because this is a work which has always been familiar to the greater number of men who are practising medicine at the present time, and who, in addition to students who are preparing for examination, will take advantage of this manual to refresh their memories upon important points. It will be noticed that the headings of the subjects are more uniform in this work than formerly, so that, in addition to osteology, arthrology, and myology, we have angiology, neurology, and splanchnology. The most important feature of an anatomy is accuracy of description, and, after carefully examining this work, the writer is unable to detect any anatomical errors. It is to be recom-J. K. Y. mended to both students and practitioners.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND,

ANI

W. S. THAYER, M.D.,

ASSOCIATE PROFESSOR OF MEDICINE IN JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

The Cause and Specific Treatment of Hay Fever.—Dunbar (Deutsche med. Wochenschrift, 1903, xxix. p. 149) contributes a most important article upon the results of his studies, which have been carried out during the last seven years, upon the nature and treatment of hay fever. These are to be set forth more completely in a work which will shortly be published.

Recognizing the fact that hay fever depended largely upon individual predisposition, a great proportion of the people being entirely insusceptible to it, great variances of opinion have existed in the medical profession with regard to the immediate eausative agent. Summer heat, dust, or other purely mechanical substances, emanations from grass or hay, and finally microorganisms have been incriminated. The researches of Elliotson and Blackley suggested that hay fever was eaused by the pollen of plants. years ago this was the more generally recognized idea. Recently, however, the theory that it was due to an infectious agent has been more popular. The author recognized the fact that the question could never be settled until the eausal agent could be obtained in pure form, until the disease could be produced at all times of the year in susceptible individuals, and, further, until it was proven that this eausal agent was efficacious only in individuals who were known to be susceptible to hay fever. In this task he has apparently met with complete success. Dunbar has shown that the pollen granules of rye, oats, wheat, rice, eorn, and all other forms of grass which he has examined contain substances which bring on all the appearances of hay fever in individuals susceptible to the disease, but are entirely without effect upon other individuals. The pollen granules of all other forms of plantsfor instance, those of linden, rose, vermuth, and many other plants which have been supposed to be dangerous, have proved to be entirely innocuous.

It was further shown that these pollen granules produced results similar to those generally recognized in the mucous membrane supplied by the

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N. trigeminus, when applied to any other part of the body—for instance, to the mucous membrane of the rectum. The same effects were observed at all times of the year. The active substance in the pollen granules was not to be extracted by alcohol or ether, but was more or less soluble in water or physiological salt solution, very soluble in tears, saliva, nasal secretion, and blood serum.

The author believes that the active substance is represented by the starch rodlets, which form the main part of the contents of the pollen granules of grass. These starch rodlets do not apparently consist of pure starch; the active substance would appear to be an albuminoid body. Numerous experiments made by the author and by Thost and Schultz in Heligoland have proven that the application of pollen in pure form or in the shape of solutions to mneous membranes produces without exception the characteristic symptoms of hay fever at all times of the year in individuals susceptible to the disease, while such application is absolutely without result in non-susceptible persons. These symptoms are to be produced not only by local external application of pollen toxin, but hypodermic injection of very small quantities produces the most severe results—conjunctivitis, coryzá, cough, asthmatic attacks, etc. The author reports a most remarkable case of this sort.

Following this discovery, the author began experiments directed toward obtaining a curative serum. Animals were injected with the pollen toxin. For months the serum not only did not neutralize pollen toxin, but rather increased its activity. Gradually, however, an antitoxin developed which completely neutralized the pollen toxin in vitro. More than that, it was possible on letting several drops of antitoxin fall into the eye or nose shortly after toxin had been previously applied, to entirely counteract its effect. This, however, has been as yet possible only in the very early stages of the manifestations. It is, however, much to be hoped that an antitoxin sufficiently strong to prove of actual therapeutic value may soon be obtained.

The important question naturally arises as to whether the toxin in all these different varieties of pollen is the same substance. Dunbar has already examined eighteen different varieties of pollen. He has already shown that the toxin of rye pollen granules is fully neutralized in vitro by the corn pollen antitoxin, while the symptoms produced by rye pollen toxin in a hay fever patient could be immediately arrested by corn pollen antitoxin. These observations would lead one to believe that pollen toxin of the various gramineæ is the same substance.

Juvenile Tabes and Hereditary Syphilis.—Linser (Münch. med. Wochenschrift, 1903, l. p. 637) reports the case of a woman, a virgin, who had suffered during childhood from frequent cutaneous eruptions, the nature of which was uncertain, as well as with glandular swellings, and presented, at the age of thirty-four, a distinct picture of locomotor ataxia. The first symptoms, of headache and dizziness, began at her fifteenth year; lancinating pains appeared at twenty, while at twenty-five the loss of light and patellar reflexes as well as paræsthesiæ were evident.

Until ten or fifteen years ago the existence of these juvenile cases of tabes was doubted by many. Twenty-one such cases have, however, been reported.

In about two-thirds of these eases ataxia was absent, though the loss of pupillary reflex, Westphal's and Romberg's symptoms, sensory disturbances, and laneinating pains were almost always noted, and often bladder symptoms and optic atrophy.

In most eases the symptoms began at puberty. An extremely slow and gradual progress of the symptoms is characteristic; long intermissions in the course are the rule. There is every reason to believe that hereditary syphilis is the main, if not the only, cause of this form of tabes. In seventeen of the twenty-one eases of juvenile tabes, syphilis occurred in one or other of the parents; in two it was probable; in two only questionable. In Linser's ease the father acquired syphilis the year before the birth of the patient and died later of general paralysis.

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

JOHN RHEA BARTON PROFESSOR OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY HOSPITAL,

AND

F. D. PATTERSON, M.D.,

SURGEON TO THE DISPENSARY OF ST. AGNES' HOSPITAL; ASSISTANT SURGEON TO THE DISPENSARY OF THE UNIVERSITY HOSPITAL.

Hard Traumatic Œdema of the Back of the Hand and Foot.—VULLIET (Centralblatt für Chirurgie, 1902, No. 42) states that it is perhaps of interest to eonsider this rare condition, which has never been previously described, and which by its sequelæ becomes a morbid condition of importance. time this condition has only been generally mentioned as one of the diseases of the hand, but its signs and symptoms are so characteristic that they deserve to be specifically mentioned. Briefly the condition may be considered as follows: (1) Etiology, usually the result of a blow upon the hand or foot; more rarely dorsal flexure of the hand may be the eause. (2) Symptoms: At first a diffuse swelling of the hand or foot, more pronounced at the base of the fingers or toes. At the height of the disease this swelling is hard and elastic and does not pit upon pressure. The back of the hand resembles an elastic cushion, without wrinkling of the skin, inflammation, or eechymosis. At points a sense of erepitation may be detected, and the thenar eminence appears normal. Examination with the X-rays shows the bones to be uninjured, the parts are painful on pressure, and motion of the fingers is painful and restricted, except the thumb, which is unaffected. (3) This disease runs a very prolonged course, the swelling remaining the same for some time, and then grows slowly less, and after a period of from eight to twelve weeks it disappears. Sometimes it lasts longer, and then one finds either a hard, well-defined knot or a diffuse, vague hardening over the

bones which rarely is permanent. A return to work should not be made while the swelling persists. (4) The pathology has never been directly studied, but theoretically there is a diffuse, fibrous exudation under the skin, which is either slowly absorbed or becomes organized. (5) The differential diagnosis from the edema of inflammation is easy, as the latter is soft and red, with a wound at the point of infection and involvement of the neighboring lymph glauds. The differentiation from ædema, due to disturbed circulation as the result of pressure, is also a simple matter. Fracture of the metacarpal bones gives more localized symptoms with ecchymosis, the duration of the swelling is shorter, union is followed by deformity due to callus formation, and an X-ray examination makes the diagnosis positive. Hemorrhage is followed by eechymoses, which are always absent in traumatic ædema. As a rule, the diagnosis is easy, but it can become a matter of difficulty when the hard and diffuse edema lasts a long while, or when it becomes localized over a metacarpal bone. In all eases one should remember the traumatic origin of the disease, and not confuse it with a chronic inflammation, such as tuberculosis. (6) The treatment should consist of warm baths. Massage has proven more harmful than beneficial, and pressure bandages proved to be perfectly useless.

Extradural Hemorrhage from Rupture of the Middle Meningeal Artery. - Jopson (Annals of Surgery, March, 1903) reports in detail three cases. In the last one the symptoms closely simulated those of extradural hemorrhage, but which operation showed it to be absent. In the first ease the line of fracture crossed the anterior branch of the artery and explained its laceration. In the second case there was no fracture; the contusion was sufficient to rupture the vessel, a possibility well recognized. As regards the . symptomatology of these eases, in the first one the classical clinical picture of extradural hemorrhage was absent, the symptoms being more those of fractures of the skull, with concussion or injury of the brain. of blood through the fissure into the subapoueurotic space probably relieved the pressure on the brain for a time and accounted for the preservation of consciousness and absence of paralysis. The temperature, slightly subnormal at first, then moderately elevated, was most suggestive of homorrhage. The slow pulse is not always observed with epidural clot, but in this case the sudden drop to 48 before operation was significant of cerebral compression. In the second case the clinical picture was most complete. The initial stunning, the interval of consciousness followed by rapidly deepening coma, with subnormal temperature, slow pulse, stertorous breathing and contralateral hemiplegia, with dilatation of the pupil ou the affected side, made up a symptom complex which searcely admitted of other interpretation. last case the diagnosis of hemorrhage, while less certain, was justifiable, and trephining strongly indicated. There was a history of loss of consciousness, followed by its partial restoration, and then in a short time a deepening coma, with severe convulsions, starting on the opposite side from the injury, and followed by paralysis of the face on that side. The exact nature of the lesion remains unknown, but it seems probable that there was a slight hemorrhage or laceration in the motor area. The measurement used for locating the trephine openings and exposing the anterior branch of the artery in the

last two eases—two finger-breadths behind the external angular process of the frontal bone and three finger-breadths above the zygoma—eorresponds very closely to the measurement formerly recommended by Treves, viz., one and one-half inches behind the external angular process of the frontal bone, and one and three-quarter inches above the zygoma. Treves now recommends a point located on a line drawn through the supra orbital ridge parallel to Reid's base line at a point from 3 to 4 cm. behind the external angular process. Pluminet has found all the measurements recommended for exposing the posterior branch to be unreliable, but Steiner's as open to the least objection. This locates it at a point where a line drawn horizontally through the glabella is intersected by a vertical line running just in front of the mastoid process.

The Technique of Lavage of the Stomach.—Neck (Centralblatt für Chirurgie, December 27, 1902) states that in washing out the stomach the question at this time is the danger attending the outflow or siphonage of the The usual procedure consists in the introduction of a tube into the stomach; then the fluid is poured into the stomach through this tube, and then siphoned off again. In many eases this flowing out goes on easily, and apparently all of the fluid introduced comes away, but sometimes there are difficulties. Occasionally it is quite impossible to get all of the fluid to flow out of the stomael, even though a large amount of solution be put in. Even moving the tube about and the consequent straining on the part of the patient fail to empty the stomach. Such difficulty is often encountered in the eases where there is a motor insufficiency of the organ, especially when complicated by gastreetasis and pyloric stenosis. The question of completely emptying the stomach of its contents is an important one before operating upon that organ, as any fluid that may be present at the time the stomach is opened only tends to complicate the operation. In order to avoid this complication the author has endeavored to find a safe and easy method by which the stomach may be completely emptied of its contents. In the usual way of practising lavage the patient is placed in a horizontal position, or else remains sitting up. The author states that he believes in retaining either of these positions only as long as the siphonage goes on freely, and then the patient should be placed in the full pelvie position, and this will be followed in nearly every ease by a return of the flow. The tube should then be slowly withdrawn (while the patient remains in this position), and as it comes out the last of the stomach contents will be withdrawn In each ease in which this method was practised the stomach was found to be completely empty at the time of operation. The author has also experimented extensively on the eadaver with this method, and in each instance with great success. In conelusion he states that in those cases where the stomach is filled with particles of food the lavage must be repeated several times before the organ is empty.

The Diagnosis of Intestinal Injury following Abdominal Contusion.— LE CONTE (Annals of Surgery, April, 1903), after giving the history and treatment of thirteen eases, states in eonelusion: First. That a moderately assured diagnosis of grave injury must be made before operation is undertaken, or one will open many abdomens to find the trauma confined to the abdominal wall. In a series of 100 consecutive cases of abdominal contusion as they enter a general hospital, perhaps 30 or 40 will have received a grave injury demanding operation, while the other 60 or 70 recover without any operative procedure. For the sake of argument, the author states that he is willing to grant that if the abdomen is immediately opened in each one of the 100 cases there will result a smaller percentage of deaths than if the surgeon waits for some other symptoms of intestinal damage. But can one call such radical and empirical treatment the science of surgery? Would any one receiving a blow on the stomach sufficient to shock and nauseate say, "Have Dr. — see me, for I want my abdomen opened at once?" swering for himself, the author says No, for he should wish the surgeon in attendance to be moderately assured of his diagnosis before taking that smallest of risks, viz., an abdominal section in the hands of the most skilful surgeon. The author states that if he were one who always, with one exception, advocated immediate operation in appendicitis as soon as the diagnosis is made, he could with greater force urge immediate operation in all cases of abdominal contusion, for the seriousness of the two conditions is scarcely to be compared. The teaching of many of the modern writers when they urge operation in all cases presenting pain, rigidity, and local tenderness, seems too radical, for there are various kinds of pain and tenderness and different degrees of rigidity, and many times these symptoms are due to injury of the abdominal wall alone. Had the author followed such teaching, he states, he would have opened the abdomen in five of the reported cases, each of which presented pain, localized tenderness, and rigidity, and yet they all recovered without any exploratory operation. One should wait for some symptom or symptoms indicative of intestinal injury. Second. In the presence of shock, one cannot make a diagnosis of intestinal injury, no matter how profound the shock may be or how slowly reaction takes place. One may diagnose hemorrhage, which would lead to an immediate operation, and at the same time presume the presence of a lacerated gut, but primary shock is of itself no aid to diagnosis. One, therefore, should wait for reaction to take place. Third. No one symptom is pathognomonic of intestinal injury, but the two most reliable are gradually increasing rigidity and facial expression. In the next group the author places deep and, perhaps, radiating abdominal pain; respiration, which becomes more and more thoracic; vomiting after the shock has ceased; distention; increased pulse-rate, and secondary fall in tempera-The order in which they have been mentioned has no significance, for any one or two of these symptoms may be prominent to the exclusion of others. Fourth, Any individual who has received an abdominal contusion sufficiently severe to call for professional services demands also the most careful and constant watching in order that one may detect at the earliest possible moment the appearance of grave symptoms. This does not mean that one should wait for these symptoms to become so pronounced that a positive diagnosis is assured, for then operation is for the most part too late. There is a position, however, midway between operating on every case and waiting for an assured diagnosis, where one can say that, owing to the gradual appearance of certain symptoms, one has fair reasons to think the intestinal tract may be injured, and that under such circumstances an immediate operation will give the patient the best chance. In such a case one must not

forget the possibility of perforation taking place hours or even days after the injury. Lastly. As one's individual experience increases, one gains the power to place a more just value upon the symptoms present and to perceive the grave symptoms in their early stages. In other words, there is a gain in acuteness of perception, and there is scarcely any injury to the body which requires this more for a successful result.

THERAPEUTICS

UNDER THE CHARGE OF

REYNOLD WEBB WILCOX, M.D., LL.D.,

PROFESSOR OF MEDICINE AND THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL.

AND

SMITH ELY JELLIFFE, M.D., PH.D.,

PROFESSOR OF PHARMACOGNOSY AT THE COLLEGE OF PHARMACY; CLINICAL ASSISTANT AT THE VANDERBILT CLINIC (COLUMBIA UNIVERSITY), NEW YORK.

The Use of Colloidal Silver in Infectious Diseases.—Dr. Netter enumerates a number of infectious diseases that have been promptly relieved by the use of colloidal silver or collargol, which was introduced as a therapeutic agent in 1897 by Credé. It is an allotropic form of silver which is soluble in water and in the secretions of the body. Colloidal silver is used chiefly for external applications in the form of a salve, 15 to 100 (Unquentum Credé), and in intravenous injections in a solution of 1 to 200. The amount of salve used in an application is 15 to 45 grains, according to whether the patient is a child, a youth, or an adult. For intravenous injections the amount varies from one-half to five-sixths of a grain. The use of · collargol has grown widely, and many physicians report remarkable cures in many different diseases. Wenchebach cites two cases of severe infectious endocarditis that were cured by means of the injections, while Klotz obtained wonderful results in a septic endocarditis. The author reports ten different kinds of cases in which he had excellent effects from this remedy, among which was a case of pncumonia in which, after intravenous injections, the fever dropped immediately and disappeared entirely in three days. purating cerebrospinal meningitis was modified as suddenly, apyrexia the day after the injections, and a rapid convalescence. The results were no less satisfactory in a severe scarlatina, two toxic diphthcritic anginas, and in three adynamic typhoids. The last observation was of a medico-surgical nature. A physician seized with pyohæmia found almost instant relief after a single application of collargol. Both the patient and the nurse who made the application noticed a distinct metallic tastc. The return of strength, appetite, and ability to move came the following day. It is not certain that collargol acts antiseptically. Perhaps there is a neutralization of the toxins which produce such rapid changes in the body, and perhaps there is stimulation of the defensive power of the organism, or a catalytic action.—Journal de Médecine, 1903, vol. xv. p. 14.

Eukinase and Pancreatokinase.-MM. HALLION and CARRION describe the therapeutic application of two new drugs, discovered by Pawlof and his disciple, Schepowolnikow; the one, eukinase, is an intestinal eupeptic and the other, pancreatokinase, is a digestive ferment. It is easy to reproduce with eukinase the experiment that shows its value as a new drug. test-tubes, in each of which are placed equal portions of the cooked white of egg, there is added to the one a little pure pancreatic juice from a healthy animal, to the other an equal quantity of pancreatic juice and also a trace of eukinase. Under like conditions of temperature, etc., the white of egg in the first tube is digested very slowly, if at all, but in the second rapidly and completely. The practical experiments of physiologists bear out the results of those in the laboratory. In many intestinal affections, whether acute or chronic, or the result of infectious diseases, such a remedy could be used. Often such dyspepsias are confounded with gastric dyspepsias. Whenever the cause is in the non-efficacious action of the pancreatic juice, eukinase will prove a most rational intestinal eupeptic, as it permits and facilitates the action of the pancreatic juice. The association of pancreatin with eukinase makes a powerful digestive, which has been called pancreatokinasc. avoid the action of the gastric juice on eukinase, it has been prepared pharmaceutically in two forms, which are proof against the gastric juice, or else the active principle may be enclosed in a gelatin capsule, in which form it is easy to give it to children.—Les Nouveaux Remèdes, 1903, vol. xix. p. 25.

The Cure of Cholelithiasis by Means of Chologen.—Dr. Robert Glaser describes the results of the treatment of a hundred cases of gallstone disease; in which he used a new preparation called chologen. He gives certain reasons which lead him to believe that cholelithiasis is a nervous and not an infectious disease. Upon this theory he bases his method of treatment. His chologen consists of three different organic quicksilver preparations, which he gives in tablet form and combines variously, making a preponderance of mercury, or of the aromatic vegetable element, as the character of the case may demand. In 73 women and 27 men whom he treated with chologen he found that 78 per cent. were cured; that is to say, they have been well ever since the treatment, having had no return of the attack, and been able to work and to digest without discomfort.—Correspondenz-blatt f. den Schweitzer Aerzte, 1903, vol. xxxiii. p. 73.

Enteroclysis in Acute and Chronic Dysentery.—Dr. V. Beller makes some excellent suggestions concerning enteroclysis in Egyptian colic and the acute dysenteries. A non-irritating enteroclysis is one of carbolic water, 20 to 40 drops of the acid in a quart of warm water. The anæsthetic action of the carbolic acid tends to greatly assuage the colic and tenesmus, and it is so rapid and constant in its effect that this treatment may be considered almost a specific for Egyptian cholera. In chronic cases it is necessary to substitute the disinfectant enteroclysis by an astringent one to diminish the glandular and mucous irritation; and to continue them for several months. An interruption is apt to be followed by a violent attack, presumably due to reinfection of the mucous membrane; but the continued use of such lavage is apt to be poorly tolerated unless one avoids difficulty in the following way: (1)

By employing a mueilaginous liquid with an astringent one—two ounces of marshmallow-root to two quarts of water—forty-five to seventy-five grains of tannin, never more. The addition of thirty to forty drops of carbolic acid anæsthetizes the mucous membrane and helps considerably. (2) Tannin may be alternated with alum and alumnol, forty to sixty grains for two quarts. With this the attacks will be less frequent and less painful. (3) The most essential thing, without which enteroelysis cannot be borne well for more than two or three days, is to give simultaneously by the mouth thirty to forty-five grains of bismuth salicylate each day. It may be alternated with dermatol or tannigen to avoid a habit. Opium should never be employed.—Revue de Thérapeutique, 1903, vol. lxx. p. 80.

Cataphoresis in Gout.—Dr. Charles Begg claims to have obtained excellent results in the treatment of chronic gout and rheumatoid arthritis by this procedure. Two methods may be employed, either the joint is immersed in a solution of the drug to be employed, the positive electrode being placed in the bath and the negative on an indifferent part of the body, or the positive electrode is kept as wet as possible by frequent applications of the solution. The author employs a large negative electrode and a small button-shaped positive electrode.—Edinburgh Medical Journal, 1902, vol. vi. p. 547.

Acute Lead Poisoning in an Infant.—DR. H. C. CADMAN reports an interesting instance of lead poisoning in an infant five weeks of age. The symptoms were those of indigestion, with eolic, the abdomen was hard and swollen. The face was of a peculiar gray color, and the child seemed dying. On close examination it was found that the mother was using a metallic nipple shield that was made of lead, and that the milk about the nipple had dissolved small quantities of it, and this was the cause of the poisoning.—
The Lancet, 1902, No. 4135, p. 1458.

Theocin.—DR. CHEVALIER has made an claborate and complete review of the various literature concerning a new alkaloid, prepared synthetically, theoein, from the chemical, physiological, pharmaccutical, and experimental. standpoint. Traube, a chemist, succeeded recently in manufacturing, in a practical and not too eostly way, synthetic theopyllin, which is so difficult to extract from the natural product, tea, which has been introduced in its available therapeutic form under the name of theocin, a soft, white, bitter powder. The quantity of water eliminated by a healthy subject is considerably inercased after the absorption of seven and one-half grains theoein. The quantity of mineral salts excreted is equally increased. It does not, however, seem to have any decided action on the elimination of the organic substances of the urine. Its efficacy has been established in eases where there was considerable edcma. There has, as yet, been no proof of irritation of the kidneys from the use of this substance. In cases where there had been albumin previously, it was not increased in proportion to the increase of the diuresis, and in other eases more has been caused. The therapeutic dose does not seem to influence the cardiac function. The frequency of the pulse and pressure of the blood are not at all modified. Its administration may

be attended at first by slight stomachic difficulty, such as loss of appetite and vomiting. It also, sometimes, has an exciting effect on nervous patients. To remedy these inconveniences it may be given in an alkaline combination or with hedonal. The doses in practical use are from three to seven grains in a cup of tea three times a day after each meal. A dose of seven and one-half grains, as in caffeine, should be considered a maximum.—Revue de Thérapeutique, 1903, vol. lxx. p. 73.

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE; PROFESSOR OF OBSTETRICS AND DISEASES OF INFANCY IN THE PHILADELPHIA POLYCLINIC; CLINICAL PROFESSOR OF DISEASES OF CHILDREN IN THE WOMAN'S MEDICAL COLLEGE; VISITING OBSTETRICIAN TO THE PHILADELPHIA HOSPITAL, ETC.

The Disinfection of the Hands and the Occurrence of Puerperal Septic Infection.—No subject is of greater interest than the prevention of puerperal septic infection, and in no subject is it more difficult to form conclusions from the mass of conflicting testimony given by various investigators.

The use of rubber gloves seemed likely to exert a most favorable influence upon puerperal morbidity and mortality. In the Zeitschrift für Geburtshulfe und Gynäkologie, Band 45, Heft 3, 1901, STICHER, from the clinic at Breslau. reports the result of his observations in 1200 cases, including labor at full term, abortion, and the different operations which these conditions sometimes render necessary. The results of his investigations may be summarized by saying that the use of rubber gloves did not appreciably reduce puerperal sentic morbidity nor puerperal septic mortality. In spontaneous labor with the use of rubber gloves the morbidity was from 10.5 to 12.1 per cent. most fatal case of septic mortality occurred in a patient not examined by any method, and hence without the possibility of external infection in the clinic. In the manual removal of the placenta the results with the use of gloves were not so good as those without their use. Sticher does not believe that any precaution should be relaxed in the cleaning of the hands or in the use of gloves whenever possible. With strict disinfection of the hands, aided by gloves, it is possible to reduce puerperal morbidity and mortality of septic infection to the lowest point. It is, however, of the utmost importance that labor should be so conducted that wounds of the genital tract be avoided as much as possible, and that the retention of membranes or placenta in the uterus should not occur. The trend of his study is to lay great stress upon the disinfection of the external genital organs and the avoidance of the introduction of contagion by contact with them. He also believes that under some conditions the patient's genital tract may contain the elements of infection, irrespective of examination.

A more recent paper than that of Sticher is contributed by Schumacher, from the clinic at Strassburg (Archiv für Gynäkologie, Band 68, Heft 2, 1903). Schumacher made bacteriological examinations of the hands of physicians, students, and midwives, and found that when the hands were well disinfected streptococci were not obtained from the integument. Lower orders of bacteria, however, were obtained from the hands, but their number was greatly reduced and also their virulence by disinfection. In fact, it was the rule, and not the exception, to obtain these less virulent bacteria from the hands. Much the same results were obtained in the clinics at Halle on the hands of persons who performed or assisted at a series of cases of abdominal section. It was curiously observed that it is easier to make the right hand free from bacteria than the left.

A comparison was then made between the number of bacteria found on the hands and the puerperal morbidity. For this purpose a series of 115 labors was investigated, with a morbidity of 17.3 per cent. It was found that in those eases in which the hands showed the presence of the yellow pusproducing bacteria, puerperal morbidity was greatest. When the hands and arms were found to be free from bacteria, the puerperal morbidity fell to 10.5 per cent. When the hands contained abundant bacteria, it rose to 15 per cent. When, however, the hands were examined in cases that had no morbidity, the surprising result was obtained that in eases proceeding normally the hands frequently contained more of the staphylococcus aureus than in those cases that had fever. The result of these studies was the failure to establish a relationship between the number of colonies of staphylococci obtained from the hands and the presence or absence of puerperal morbidity. While we cannot render the hands free from all bacteria, we do remove streptococci by faithful cleansing, and we cannot prove that the remaining germs markedly influence purperal morbidity and mortality.

When hands covered with rubber gloves were examined, it was found that it was possible to remove bacteria in most eases from the surface of the gloves. In some cases, however, the less virulent forms of bacteria were still present. The use of gloves, however, was followed by a very slight difference in puerperal morbidity and mortality. So far as the use of gloves in examinations was concerned, it could not be ascertained that their use occasioned a distinct improvement. Those bacteria which remained upon the hands after faithful disinfection had no influence upon the puerperal state. For normal labors and for the purpose of teaching, Schumacher did not find that the use of rubber gloves should be recommended. When, however, the hand has been recently infected, or when there is reason to fear infection of the hand, then the use of gloves is alike proper for the defence of the patient and also the physician.

Stolz, of Graz, has recently published a book of over 300 pages, entitled Studies in the Bacteriology of the Genital Canal during Pregnancy and the Puerperal State. This book bears directly upon the question under discussion.

He found in the secretion of the vagina pathogenie baeteria in normal and pathological eases. The so-ealled destructive influence of the vaginal secretion, he believes, has not been proven. Likewise in the puerperal state he found but 50 per cent. of lochial discharges practically sterile, and does not

believe that the uterus in normal cases is germ free. His technique was as thorough as possible and after approved methods. He did not find that repeated examinations during labor, the length of labor, the length of the third stage, lacerations of the perineum, and operations done with sterilized hands played any essential part in increasing the bacteria found in the lochial discharges. The one feature which greatly increased the bacterial contents of the lochia was retention of the membranes.

In patients having an afebrile puerperal period the lochia contained bacteria in 80 per cent, and streptococci in 36 per cent, the increase in germs taking place soon after the patient's delivery. When fever occurred in most cases the uterus succeeded in cleansing itself from bacteria. The streptococcus was most frequently present in these cases. In 15 per cent, the uterus relieved itself spontaneously of the infective agent. Intra-uterine douches of 1 per cent, lysol were useful, especially in removing retained membranes or blood-clot.

The use of rubber gloves did not materially alter the results previously stated. A case of fatal infection occurred in a patient examined with the use of rubber gloves only. Operations performed by hands covered with sterile gloves gave no better results than those done with disinfected hands. Only in the case of very frequent examinations did the use of the gloves seem to be an advantage. The result of this book is to emphasize the possibility of autoinfection by the ascent and absorption of bacteria already within the vagina at the termination of pregnancy.

Two Cases of Lateral Section of the Pelvis by Gigli's Method.—Pesta-Lozza (*Centralblatt für Gynäkologie*, No. 4, 1903) reports two cases in which he practised this operation in his clinic at Florence.

The first case was a woman in her seventh pregnancy, who had lost children from birth pressure in previous labors. She had a symmetrically contracted pelvis, whose internal anteroposterior diameter was between 8 and 9 cm. The child was large. The patient had had strong pains, but the head remained movable above the pelvic brim. On cutting through the skin slight hemorrhage occurred, as the incision was carried a little too far down and too near the vulva. This was readily controlled. The bone was very easily separated by a chain saw and the child readily delivered by forceps. The wound was closed without drainage and union occurred by first intention, the temperature remaining normal. The pelvis completely united. The child weighed 3850 grammes, and nursed well until the twenticth day. It then died suddenly in convulsions. Upon autopsy a slight icterus and slight eedema of the brain were the only lesions found.

His second case was in her third pregnancy, and had had two small children in spontaneous labor. Several attempts were made to bring the head down by forceps, but without success. After section of the left pubic bonc, a living child, weighing 3800 grammes, was readily delivered. The wound was closed by deep sutures passing through the fascia and periosteum. There was no drainage. The patient's temperature rose to 100° on the second day, but speedily fell. Mother and child made a good recovery.

In comparing this operation with symphysiotomy, the writer draws attention to the fact that it would be possible to wound the bladder. There is no

especial danger of this, however, if the operator exercises reasonable eaution. In these cases the urine was bloody for a short time after the operation without assignable cause. A eatheter was placed in the bladder during the operation to hold the urethra out of the way.

GYNECOLOGY.

UNDER THE CHARGE OF

HENRY C. COE, M.D.,

ASSISTED BY

WILLIAM E. STUDDIFORD, M.D.

Colon Bacteria in the Peritoneal Cavity.—Soliere (Ziegler's Beiträge zur path. Anat., Band xxxi.), after reviewing the literature of the subject, reports the results of his experiments with guinea-pigs, in which he aimed to increase the power of resistance of the healthy peritoneum to infection by injecting into it a sterile solution of saline, fresh broth, and sarcolin. A drop of fluid containing colon bacilli was then introduced into the cavity through a hypodermic syringe. Beginning with the smallest fatal dose the writer was able to gradually increase it up to twenty-three times this strength, by giving a prophylactic injection of the before-mentioned solution the day before. It was thus proved that the power of resistance of the peritoneum could be increased from seven to sixteen fold.

Biondi conducted the same experiments in three human subjects, using prophylactic injections of from 30 to 60 e.e. of normal salt solution. In two instances the subsequent removal of ascitic fluid allowed precise conclusions to be drawn with regard to the presence of the bacteria. In spite of the use of these preventive measures, there may be so many bacteria present that the peritoneum cannot withstand them, and death occurs speedily, or a less rapid fatal result may follow from the setting free of toxins from the phagocytes.

Disadvantages of Ventrofixation.—Gradenwitz (Zeitschrift für Gynäkologie, 1903, No. 5) summarizes a paper on this subject, as follows: Suture of the stumps to the abdominal wall after removal of the adnexa is unnecessary, if continuous suture of the broad ligament is practised instead of transfixion and ligation. Ventrofixation by suture of the round ligaments without removal of the adnexa, exposes the patient to the dangers resulting from the formation of pockets; a better result can be obtained by Alexander's operation. Fixation of the fundus uteri offers the most permanent relief for retroflexion, but should be rejected on account of the danger of metritis, hernia, and subsequent disturbances attending pregnancy and parturition. Shortening of the round ligaments or vaginal fixation is preferable.

Thrombosis following Abdominal Section.—RIEDEL (Centralblatt für Gynäkologie, 1903, No. 3) reports eight cases in which the thrombosis was on the left side, and three on the right. Two of the latter followed fixation of the right kidney. The left vein was affected in five cases of appendicitis, in one of which no operation was performed. The thrombosis in most instances did not develop until several weeks after operation, and the majority of the cases were aseptic (?).

The writer attributes the complication to the prolonged recumbent posture, and explains its greater frequency in the left vein as due to the pressure of the superimposed arteries, which cross it at a more obtuse angle than on the right.

Adhesions following Laparotomy.—Pemhorst (Inaugural Dis.; abstract in Centralblatt für Gynäkologie, 1903, No. 6) studied sixteen cases in which the condition of the abdomen was noted at the time of a secondary operation or at autopsy. In all a previous abdominal section had been performed, and the most careful means had been employed to prevent the formation of adhesions by covering the stumps and raw surfaces with flaps of peritoneum, making as small an incision as possible to avoid the entrance of air and suturing the peritoneal edges exactly, and filling the bladder before closing the cavity.

In only four cases were adhesions absent, mostly between the omentum and the abdominal wound. In three cases they were slight, in four extensive, in three there were adhesions of the intestines to the stump. If there was elevation of temperature after operation they were always found, but in three cases the convalescence had been afebrile. The writer concludes that adhesions are the result of local inflammation, and that they cannot be prevented by the most rigid aseptic precautions.

Results of Hysterectomy for Cancer of the Uterus.—GLOCKNER (Centralblatt für Gynäkologie, 1902, No. 52) reports the results of operations at the Leipzig Clinic between 1887 and 1901. Nine hundred and seventy-four cases of cancer of the uterus were treated, 260 of which were regarded as suitable for radical operation. Vaginal hysterectomy was performed 225 times, 4 patients were subjected to collotomy, and in 24 the combined method was adopted. The peritoneum was sutured in 115, and the cavity was left open in 139; 22 died, or 8.46 per cent. Injuries to the uterus, bladder, or intestines ocurred 18 times, 4 being fatal.

One hundred and sixty-two cases were kept under observation for five years, of which 47 (35.6 per cent.) remained free from recurrence.

Etiology of Tubal Pregnancy.—OPITZ (Zeitschrift für Geb. u. Gyn., Band xlviii., Heft 1), from a study of twenty-three specimens of tubal gestation, arrives at the conclusion that the cause of arrest of the impregnated ovum in the tube is the presence in the latter of cul-de-sac formed by the adhesion of neighboring folds of mucous membrane, the result of previous attacks of salpingitis. These false cavities were found in every specimen examined by examining numerous serial sections. This explanation has not been offered by any previous observer.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

EDWARD JACKSON, A.M., M.D., OF DENVER,

AND

T. B. SCHNEIDEMAN, A.M., M.D., PROFESSOR OF DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC.

Operation for Conical Cornea with the Galvanocautery.—Dodd, London (Medical Press and Circular, 1903, No. 7), operated on a girl, aged nineteen years, affected with double conical cornea, with the galvanoeautery, using a modified method of Critchett's operation. Critchett's method is to apply the cautery to the centre of the cornea until almost a concave depression is formed, taking care not to perforate into the anterior chamber. Other operations have been suggested, such as cutting off a small superficial flap of the cone and subsequently cauterizing the denuded surface; repeated paracentesis, to let out the contents of the anterior chamber to lessen the intraocular tension; removing a small disk from the apex of the cone with a specially made trephine; the excision of an oval piece of the cornea.

All of these operations result in a thick, central scar, requiring an iridectomy for visual purposes. To avoid the necessity of the latter, Dodd applies a small galvanocautery in a series of dots about 1 mm. apart, so as to form a horseshoe-shape around the cone, leaving the centre free. The operation may have to be repeated at intervals to get sufficient contraction.

Operation for eonical cornea is the only treatment which holds out hope. The vision in these cases is extremely defective, and cannot, as a rule, be made satisfactory by any form of glass.

Plastic Artificial Vitreous in Mules' Operation.—OATMAN, Brooklyn (Medical Record, March 7, 1903), reports three cases of Mules' operation, in which paraffin instead of a glass ball was used as an artificial vitreous.

When from any eause a fistulous opening has once formed over an artificial vitreous it resists all attempts at repair until the foreign body has been expelled. Under these circumstances it seemed to the writer that if a portion of the ball could be removed and the tension on the seleral walls relieved closure of the wound over the remainder might be hoped for later. For this reason he selected paraffin for the artificial vitreous, so that, if necessary, it could be removed piecemeal.

Oatman draws the following conclusions from his ease: When fistula follows the Mules operation it will close spontaneously if a sufficient quantity of the artificial vitreous can be removed. That which remains will form a good support for an artificial eye.

Paraffin used for this purpose is prone to produce fistula by softening and

getting between the lips of the wound or into the track of a suture. These accidents are to be avoided by using paraffin or some modification thereof that will not soften at body temperature; also by suturing the scleral wound with silk, so that no aperture remains through which paraffin can exude.

A plastic material like paraffin will adapt itself to any inequalities on the surface of the glass shell, and ulceration from pressure is not apt to occur.

An Astigmatism Cured by Tenotomy.—Bull, Paris (New York Medical Journal, 1903, No. 6), reports a case of myopic astigmatism of 1.75/D against the rule, shown by the ophthalmometer to be almost entirely corneal, which disappeared after complete tenotomy of the external rectus of that eye. The author remarks that the importance of the case depends not upon the cure of the astigmatism, but upon the light which it throws upon other questions, obviously that of the intraocular tension. Inverse astigmatism, sometimes progressive, so common in glaucoma, may find its explanation in the position and relative tension of the ocular muscles.

[Dr. Bull makes some just remarks upon the improper term astigmatism, for which he proposes the philologically correct form astigmia. The word astigmatism is derived from \acute{a} , privative, and $\sigma \tau \iota \gamma \mu a$, genitive, $a\tau \circ s$, a stain or prick, and this, of course, does not express our meaning. Astigmia comes from \acute{a} , privative, and $\sigma \tau \iota \gamma \mu \eta$, genitive, $\bar{\eta} s$, a mathematical point—just what we intend to say. He also suggests that the expressions "with the rule" and "against the rule" be replaced by the single terms "direct" and "inverse." These sensible suggestions should find ready acceptance.]

Treatment of Hypopyon Kerato-iritis.—Burnham, Toronto (Lancet, December 6, 1902), advocates purely constitutional treatment of this condition, dispensing with all local interference save atropine once every day or second day and bathing with hot water or boric acid solution. The internal remedies are the combined treatment—mercury and iodide of potash by the mouth, and pilocarpine hypodermically. He claims for this plan rapid relief from pain and general improvement, no relapses, and, finally, great diminution in the cicatricial opacity.

Treatment of Trachoma by the High-frequency Ourrent.—Dr. Walsh, London (Medical Press and Circular, 1903, No. 7), has had an extremely favorable result in treating a single case by the high-frequency X-ray current. Apparent cure was, in fact, obtained after twenty-two applications. The applications were made to the uneverted lids. The period of exposure ranged from eight to fifteen minutes; generally the latter.

Amaurotic Cat's Eye.—Scheidemann (Berliner klin. Wochenschrift, 1903, No. 2) describes two enucleated eyeballs which had exhibited the appearances of the amaurotic cat's eye, but were very different pathologically: the one was a case of glioma, the other an intraocular cysticercus. The author emphasizes the favorable results of early enucleation in glioma, and calls attention to the occasional occurrence of sympathetic irritation of the other eye in cysticercus. The latter disease has become rare in Germany since the governmental inspection of mcat.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF
SIMON FLEXNER, M.D.,
PROFESSOR OF PATHOLOGY, UNIVERSITY OF PENNSYLVANIA.

ASSISTED BY

WARFIELD T. LONGCOPE, M.D., RESIDENT PATHOLOGIST, PENNSYLVANIA HOSPITAL,

AND

F. P. GAY, M.D., .

ASSISTANT DEMONSTRATOR OF PATHOLOGY, UNIVERSITY OF PENNSYLVANIA.

Further Communications upon the Pathogenesis of Icterus.—Eppinger (Beiträge zur Path. Anat. u. z. All. Path., 1903, vol. xxxiii. p. 123) in the present communication extends his former observations made upon the purely mechanical forms of icterus to a consideration of other varieties of this affection. The author now states that in the typical cirrhoses of Laennec, certain of the bile capillaries or so-ealled precapillaries are much constricted or even completely closed by the new connective tissue growth in the portal spaces of the liver. As a result there ensues a dilatation of the bile capillaries with ultimate rupture and escape of bile into the perivascular lymphatic spaces. A study of the liver from cases of phosphorus poisoning, representing the type of toxic jaundice, showed that the trabecular bile duets were occluded by small thrombi. This led to stasis in the intercellular bile capillaries with subsequent widening and, as in the cirrhotic livers, to rupture of the capillary walls, followed by a pouring out of the bile into the perivascular lymph spaces. In still a third variety of jaundice, "the cyanotic ieterus," following upon a chronic congestion, and due principally to eardiac disease, thrombi were again found occluding the bile capillaries. Thus the author explains the icterus accompanying cirrhosis of the liver as well as the jaundice of phosphorus poisoning and cyanosis, upon a mechanical obliteration of the finer bile duets, with rupture of the ducts and escape of bile into the lymphatics.

The Influence of Nephreetomy upon Absorption (an experimental study from the Rockefeller Institute for Medical Research).—Meltzer and Salant (Journal of Medical Research, 1903, vol. ix. p. 33), in a former study upon the effects of subminimal doses of strychnine upon nephrectomized rabbits, noted that such animals could receive much more than the fatal dose without manifesting any reaction. This result suggested that in nephrectomized animals absorption from the subcutaneous tissues might be decreased. In order to determine the power of absorption in animals in which the kidneys had been removed, rabbits were subjected to double nephrectomy, salt solution was introduced into the peritoneal cavity, and after a varying time the animals were killed, the peritoneal cavity opened, and the amount of fluid absorbed measured. Contrary to expectation, it was found that

with an 0.8 per cent, solution of sodium chloride absorption was as good and often better in nephrectomized animals than in normal animals. 1.2 per cent. solution of sodium chloride, which is decidedly hypertonic, the difference between absorption in normal and nephrectomized animals was even greater, absorption being decidedly greater for the nephrectomized animals. With 1.5 per cent. solutions, it was frequent to find an increase of fluid in normal rabbits, whereas this never occurred in nephrectomized animals. The increase of absorption for the nephrectomized rabbits continued to manifest itself even when solutions were introduced into the peritoneal cavity about twenty-four hours after nephrectomy. At a period of about forty hours, however, the factor favoring absorption began to diminish. When the fluids were left in the peritoneal cavity for five hours or longer, the rates of absorption in the normal and abnormal animals were about the same.

From these experiments the authors conclude that after nephrectomy in rabbits the osmotic pressure of the blood is increased, and therefore in these animals solutions of sodium chloride are readily absorbed from the peritoneal cavity. The osmotic pressure of the blood of nephrectomized animals appears to correspond to the osmotic pressure of a solution of sodium chloride, having a concentration somewhere between 1,2 per cent. and 1.5 per cent. This increased power of absorption following immediately upon removal of the kidneys seems to explain the absence of ædema after nephrectomy in animals, and after prolonged anuria in human beings. The first effect of anuria, according to the authors, is not an increase of lymph in the tissues, but rather an increase of absorption from the tissues into the circulation, thereby preventing edema.

Eleven Acute and Eighteen Chronic Cases of Influenza Proved by Bacteriological Examination.—LORD (Boston Medical and Surgical Journal, 1902, vol. cxlvii, p. 662) has investigated the cause of cough and expectoration in 100 cases in which sputum examination proved negative for tubercle bacilli. In the sputum of 60 of these patients he found influenza bacilli. The sputum in 29 cases showed the presence of influenza bacilli in such overwhelming numbers that these organisms appeared to be the cause of the cough. In the other 31 instances in which influenza bacilli were found, they were mixed with pneumococci, staphylococci, and streptococci, and were considered as possible secondary invaders. Some of the cases were acute and others chronic, the latter being often of several years' duration. Many of the chronic cases were mistaken for chronic bronchitis, and a few in which paroxysmal dyspnœa was a prominent feature closely resembled asthma. The author concludes that, apart from an epidemic of influenza, infection of the respiratory tract with influenza bacilli is not uncommon.

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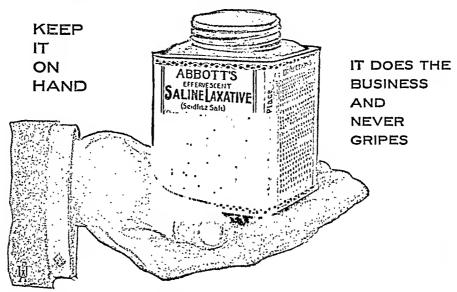
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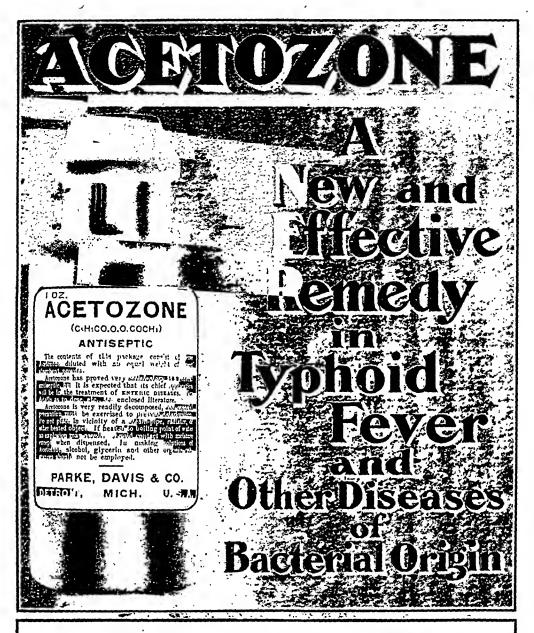
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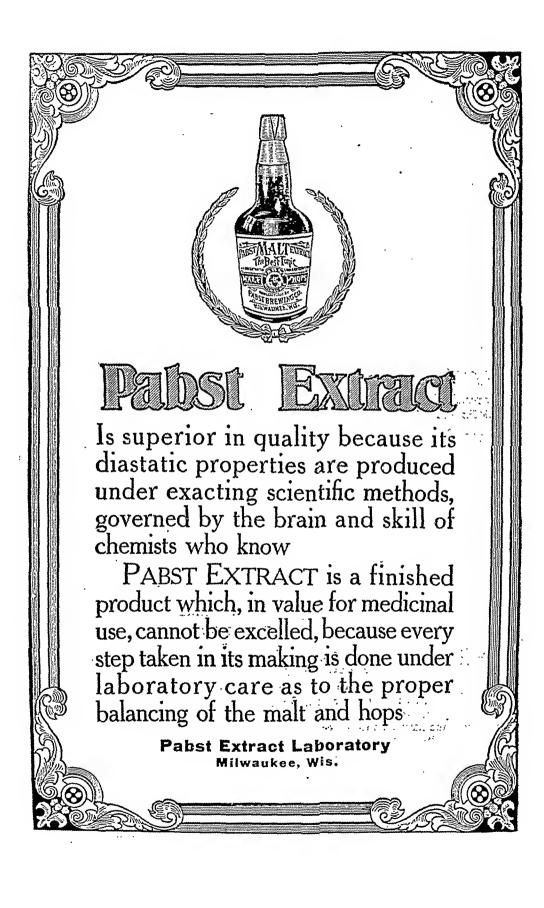
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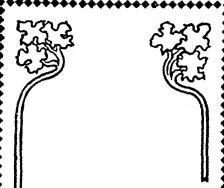
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OCTOBER, 1903.

HYPERTROPHIC OSTEOARTHROPATHY: WITH REPORT OF TWO CASES.¹

BY THEODORE C. JANEWAY, M.D.,
LECTURER ON MEDICAL DIAGNOSIS, UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL COLLEGE,
NEW YORK CITY.

THE small number of cases of this condition hitherto published in this country (nine in all), rather than its clinical importance, must be my excuse for reporting my observations on two patients who presented in differing degree the striking picture of the affection. It is important in any unusual or newly differentiated morbid condition that sufficient observations should be recorded to afford a secure basis for generalization and interpretation. In the present instance the name most frequently applied to it is sufficient proof of the foregoing statement. Marie's original publication in 1890 was entitled "De l'osteoarthropathie hypertrophiante pneumique," because, in the cases which he described, the change in the bones had seemed secondary to lesions of the lungs. Subsequent cases have shown conclusively that this connection is by no means constant. As early as 1889, and again in 1891, in an article written before the appearance of Marie's, v. Bamberger discussed eleven cases of a similar nature under the heading "Knochenveränderungen bei chronischen Lungen- und Herzkrankheiten," but the lack of a new definitive appellation left Marie's unwieldy and, in some cases, inapplicable name the field, and the bulk of recorded cases will be found under hypertrophic pulmonary osteoarthropathy. Arnold, shortly after, proposed secundare hyperplastische ostitis as a substitute; Massolongo, followed by Thayer, secondary hypertrophic osteoarthropathy; and Sternberg, writing in Nothnagel's Specielle Pathologie und

Rend before the Section on Medicine, New York Academy of Medicine, May 19, 1903.
vol. 126, NO. 4.—OCTOBER, 1903.

Therapie, toxigene osteoperiostitis ossificans. To the latter name the objection can be urged that, at least in some cases, the toxigenic origin is not demonstrable. Inasmuch as the bulk of the literature on the subject is now indexed under osteoarthropathy, it seems wise to me to retain this distinctive name, even though Freitag objected that all cases do not show joint lesions, and omit all uncertain qualifying adjectives; though, for the sake of the medical student and of one's own power of articulation, wishing it might be otherwise.

The essential lesions of the condition produce such characteristic changes in the contour of the extremities and are so well defined in radiographs, that I will first record the important features of my own cases and call attention to the accompanying pictures, returning to the general consideration later.

CASE I. — J. T., aged twenty-two years. Single. American. Formerly employed in out-door labor. Father died of tuberculosis. Drank and smoked up to one year before. No previous illness. Came to University and Bellevue Hospital Medical College Clinic February 26, 1902.

Present illness began with a cold six years before. For two years this persisted without much annoyance until suddenly one day, without known cause, he coughed up a large amount of purulent matter. There was no pain or dyspace accompanying this, no acute illness, accident, inhalation of foreign body, nor disturbance of general health.

From that time on this sudden raising of large quantities of purulent sputum recurred at regular and diminishing intervals; for the first year once a day, of late four or five times a day. Twice in the last two years he had been in bed with fever, etc., called pneumonia. For one year the sputum had been distinctly fetid and at times streaked with blood. While being examined he coughed up about eight ounces of greenish pus with an exceedingly fetid odor, which streamed out of mouth and nose. For two years sweats at times. For the last two years he had noticed progressive enlargement of his hands and feet.

Physical Examination. Height about five feet eleven inches; somewhat emaciated; color sallow. Weight one hundred and fifty-two pounds. One was struck with the tremendous size of the hands and feet; the finger ends clubbed, with characteristic curving of nails; color somewhat cyanotic. Face showed none of the changes of acromegaly, and the hands were of a different type. The lower third of leg and arm were much enlarged, so that both had a nearly straight outline from knee and elbow to ankle and wrist. This was evidently due in part to increase in the soft tissues and in part to marked thickening of the bones. There was no pitting. Pulse 90. Temperature normal.

the bones. There was no pitting. Pulse 90. Temperature normal.

The chest showed marked dulness over lower part of right lung, which in fourth space anteriorly changed to a cracked-pot note after raising the abundant secretion mentioned. Over this there were cavernous respiratory murmur and voice. Elsewhere over the dull area feeble respiratory murmur and voice, and abundant coarse, liquid râles. At the left base there were scattered coarse râles. The heart was normal, the liver and spleen not enlarged. Fluoroscopic examination showed a heavy shadow over right lower chest. Urine negative.

Sputum fetid, purulent, contained diplococci and bacilli in large number; no tubercle bacilli on two examinations; a few Charcot-Leyden

crystals.

The condition was evidently one of bronchiectasis with fetid bronchitis and secondary hypertrophic osteoarthropathy. Radiographs made at this time show very clearly the irregular deposition of periosteal new bone on the shafts of tibia, fibula, radius, and ulna, with much thickening of their lower third. The bones of the hand and foot show little change.

An operation for drainage of the bronchiectatic cavities was consented to. On March 26th Prof. B. F. Curtis opened the thorax over the area of cracked-pot resonance. The pleura being found free, it was decided to set up adhesions and open the lung at a second operation. Recovery from chloroform was good, but unfortunately the patient could never be brought to consent to the subsequent step and left the hospital.

On May 23d the accompanying photographs were taken. At that time the enlargement of the distal extremities of arm and hand were more pronounced in contrast to the general emaciation. A detail of the measurements taken at this time would be of no value, but the fol-

lowing series emphasizes the picture:1

	Forearms.		Right.	Left.
Length.	Int. condyle to styloid .		. 26 em.	26 em.
Cireum.	10 em. below condyle .		. 23 "	22 . "
44	15 cm. " " .		. 20.5 "	19.5 "
"	20 cm			19,5 "
"	1 cm. above styloid .		. 21 "	19.8 "
44	of hand around knuckles		. 21.5 "	21. "

The measurements show very sharply the loss of the normal taper toward the wrist in the contour of the forearm. At this time the patient developed considerable enlargement of the knee-joints, without pain. This was in part due to an actual effusion into the joint. At no time was spontaneous pain in the bones marked.

During the fall of 1902 his condition was unchanged, but on January 4th he became very ill, with fever, dyspnæa, increase in amount and fetor of the sputum, and died January 22d. Unfortunately he lived on Long Island, and his death was not reported to me until after the

funeral; so no autopsy was obtained.

Case II.—S. B., aged twenty-eight years. Married. Polish. Tailor. Family history negative. Temperate habits. Came to University and

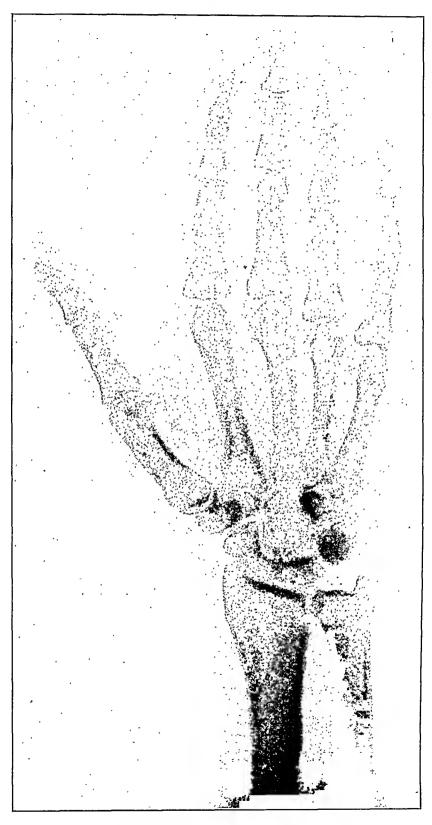
Bellevue Hospital Medical College Clinic May 21, 1902.

Present illness began eight years before with pain in right side and hard, continuous cough. From the start he says that he raised much mucopurulent sputum with a very fetid odor. He was in bed at home seven months and became much emaciated, but in the summer he improved and went back to work. The next winter he was in the Eastview Hospital, Westchester Co., for eight months, working again in the summer. Since that time there has been the same recurring cycle, sick

¹ In Thayer's Case IV. the corresponding measurements were: circumference, 1 cm. above styloid, 17 cm. on each side, the length of forearm being the same, 26 cm.; Marie's original Case B showed a circumference at the level of styloid of 23 cm.; normal wrist measure would be about 16 cm.



Case I .- Radiograph of forcarm and hand.

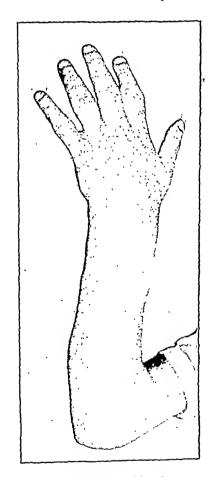


Case II.—Radiograph of forcarm and hand.

most of the winter and comparatively well in summer. His weight in summer reaches one hundred and seventy-five pounds. For five years he has had bloody expectoration for three or four days, at intervals of about four months. For six years patient had noticed increasing size of his hands and feet and at times spontaneous pain in legs. No history of inhalation of a foreign body could be elicited. His complaints were of pain in the right chest, restriction of respiratory movements with some dyspnæa on exertion, and cough with expectoration on rising in the morning.

FIG. 3.

FIG. 4.



Case I .- Arm and hand.

Case II .- Arm and hand.

Physical Examination. Height five feet eight and three-quarter inches. Weight one hundred and eighty pounds. Healthy color. Hands markedly enlarged in all measurements; finger ends clubbed. Nails very large, curved, color slightly cyanotic. Feet show some changes in a less degree.

The ankles and wrists seem definitely, though slightly enlarged,

without ædema or increase in soft parts.

Measurements of forearm and hand.						Rig	ht.	$L\epsilon$	eft.	
Length .							27-1.	2 cm.	27	cm.
Circumferen	ce 7 o	em. a	hove	wri	st.		19	44	19	**
"	at	wris	t.				18.5	**	18.5	tt
"	of	hand	abo	ut k	nuck	les	22	* 65	22	**

The chest showed a circumference of 18½ inches right, 18 inches left. Heart normal, not displaced. Lungs: right, marked duluess below fourth rib anteriorly, with slight dulness a space higher. Posteriorly, marked dulness in right interscapular region, with some dulness in suprascapular and infrascapular regions. Over the interscapular region were cavernous respiratory murmur and voice sounds, with coarse, consonating râles. Below, the respiratory murmur was bronchovesicular and the râles smaller. Above and anteriorly were coarse mucous râles, without marked change in respiratory murmur or voice. The left side was normal.

Fluoroscopic examination showed a deep shadow in the right interscapular region, with a lighter shadow below. Two examinations of sputum failed to show tubercle bacilli. The diagnosis seemed probably fibroid induration of the right lower lobe, with bronchiectatic cavities, perhaps secondary to the condition of fetid bronchitis and bronchiectasis, though a tuberculous origin could not be excluded; secondary hypertrophic osteoarthropathy.

The latter condition, as shown by the photographs and measurements, was not nearly so pronounced as in Case I. The radiographs show some irregular osteophytic outgrowths on the shafts of radius and ulna, less on tibia and fibula. The general contour of the bones is

preserved.

This patient when last seen, a few months ago, was in the same condition. There have been no joint swellings at any time, though a little pain in the joints.

These cases illustrate sufficiently well the symptomatology of Marie's and v. Bamberger's types of the affection. Both have the great enlargement of hands and feet, with the clubbed fingers and curved nails. The latter shows, in addition, a moderate thickening of the distal ends of forearm and leg bones. In the former this is much more pronounced, involves probably the whole length of the shaft in some degree, and affects also the other long bones, and there is a conspicuous swelling of the joints, best appreciated in the knees. My two cases differ from the classical descriptions only in their comparative freedom from pain in the bones involved.

Pathological Anatomy. Two distinct sets of changes are found at autopsy in this condition, one involving the bones, the other the soft parts. The bone lesion is practically described by the name osteoperiostitis ossificans. There is a chronic inflammatory process which leads to rarefaction of the central cancellous bone and to the production of layers of osteophytic growth at the periphery (Lefebvre, v. Bamberger). In the ordinary cases this has involved especially the lower third of radius and ulna, tibia and fibula, to a less extent the carpal, metacarpal, and proximal phalangeal bones, and the lower end

of humerus and femur. The terminal phalanges show very little thickening. In the extreme cases, such as the skeleton pictured by Sternberg, there is marked irregular thickening of all bones, and the spinal column shows kyphosis and scoliosis. Histologically, round-cell infiltrations and thickening of the vessel walls have been found (Sternberg). Chemical analysis shows too high a proportion of magnesium salts and of fat (Lefebvre).

In the joints Thorburn found some excess of fluid and erosions of





CASE I.

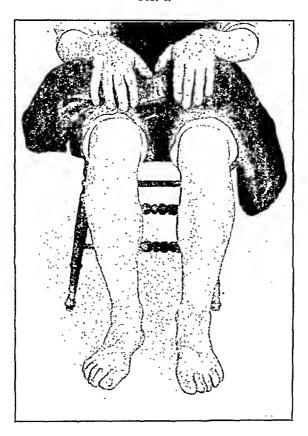
the cartilages. The soft parts show a marked increase, especially in the terminal phalanges, and to this the Hippocratic fingers are due. Buzzard found the increase of subcutaneous fat most noticeable; Hirschfeld considers the hypertrophy as affecting chiefly the skin. Freytag saw great distention of the capillaries in the bed of the nail.

The two questions which concern us at present in the discussion of this obscure process are:

1. What shall we include under the term hypertrophic osteoarthropathy?

- 2. What is the real cause of the pathological changes in the bones and soft parts?
- 1. What shall we include under the term hypertrophic osteoarthropathy? Of cases clinically resembling the original descriptions of v. Bamberger and Marie, there can be no question. A glance at the literature, however, shows two classes of a different kind reported under this name. These are the cases with similar changes in the bones and soft tissues of the extremities, but in whom no primary dis-





CASE II.

ease existed previous to the onset of the deformities (see analysis of cases), and, on the other hand, the ordinary clubbed fingers met with in chronic heart and lung affections. The first class, I think, from the identity of the lesions, must be admitted as hypertrophic osteoarthropathy, even though the term secondary does not seem to apply. As to the clubbed fingers, however, there is much discussion. Freytag excluded them from consideration. Lefebvre, however, considered them phenomena of the same order and was misquoted by Sternberg, who also classes them as the mildest type of the condition, thinking it best

to group all the material from a clinical standpoint until our knowledge of the actual etiology is greater.

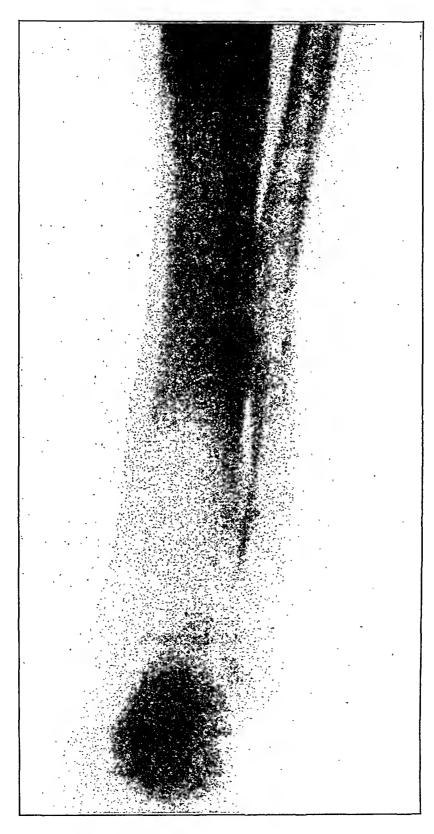
Before many autopsies had been recorded, and while radioscopy was unknown, it was supposed that the clubbed fingers in osteoarthropathy depended upon thickening of the phalangeal bone. This, however, has been proven false, almost the whole size being due to hypertrophy of the soft parts. The recent observations of Schittenhelm are important in this connection. In an advanced case of osteoarthropathy of Marie's type he saw, between May and July, 1901, moderate diminution in the size of the hands. Careful measurements of radiographs during this period demonstrated that the retrograde change involved the soft tissues almost exclusively. A fourteen-day metabolism experiment during the same period, with known P: N ratio in the food, showed normal phosphorus excretion in the urine.

Other instances of improvement in the condition of the extremities with cure of the primary disease have been reported by Godlee and Mettenheimer (empyema), and Schmidt (syphilis); and in simple clubbed fingers secondary to empyema Gillet and Moizard saw their complete disappearance and Moussons their marked diminution.

In the light of the very evident clinical relationship, it therefore seems wise to me to consider the conditions as different stages of the same process until a case is found with the bone lesions and no clubbed fingers, or until a certain and different etiology is proven for the two manifestations. It is probable that careful radiographic observation of the distal ends of radius and ulna might show slight thickenings in many cases of simple Hippocratic fingers. Von Bamberger's cases 8, 9, and 11 were clinically of this type, the slight osteophytic growth being found first at autopsy.

- 2. What is the real cause of the pathological changes in the bones and soft parts? No certain answer can be given to this question to-day, and we can only consider the theories advanced in the light of our present knowledge. As these are largely based upon the association of the symptom-complex with certain primary lesions of other organs, a grouping of the recorded cases under these primary diseases must be made. Teleky, in 1897, made the following classification of causative conditions:
- 1. Diseases in which suppurative or gangrenous processes occur: Tuberculosis of the lungs (with cavity formation), bronchiectasis, empyema, pyelonephrosis, dysentery. The most common causes.
- 2. Infectious diseases and chronic intoxications: Pneumonia, pleurisy, influenza, syphilis, chronic jaundice, alcoholism.

¹ This is the only trustworthy metabolism experiment in osteoarthropathy, Guérin and Étienne, who claimed to have found increased Ca and diminished P in the urine, having failed to estimate the amount in food or feces.



CASE I.—Radiograph of leg.

- 3. Valvular heart lesions, especially congenital.
- 4. Malignant tumors: Sarcoma and carcinoma of the lungs; parotid sarcoma.

Teleky added a fifth group, diseases of the nervous system, especially syringomyelia, but the bone changes here are of a different nature.

Thayer, in 1898, gave a classification of 55 cases, in which 43 were secondary to disease of the lungs and 12 to other causes.

As neither of these authors has so arranged the material that we can refer from their classification to the original sources, it has appeared worth while to me to group all the cases which I could find in the available literature to January 1, 1903, giving the names of the reporters, so that any future reclassification might begin at that point.

Types of Marie and v. Bamberger, Ninety-three Cases.

The condition followed:	C	1888.	
Bronchiectasis	٠	20	v. Bamberger, 7; Doebhelin, 2; Freytug, Godlee, Massolongo, Sitta, Thayer, 4; Walters, Janeway, 2.
Pulmonary tuberculosis with cavitie	s.	14	v. Bamberger, 2; Fracutzel, Hirschfeld, Lockwood, Mettenheimer, O'Carroll, Packard, v. Recklinghausen, Teleky, Therese cit. by Lefebvre, Thorburn, 2; Whitman.
Етруста	•	11	Davis, Demons et Binaud, Godlec, 3; Le- fehvre, Prokop a Stretti, Rauzier, Sol- lier, 2 Springthorpe, Villard.
Chronic hroughitis		6	Edgar, Field, Gerhardt, Gillet, Stemho, Sternherg [also pleural effusion].
Abscess of lung		1	Kerr.
Pulmonary tuberculosis, no cavities		1	Mestre.
Pulmonary tuherculosis and spinal ca	aries	1	Thorhurn and Westmacott.
Chronic pleurlsy and spinal carles .		1	Orillard.
Chronic pneumouia		1	Schittenhelm.
Retracted chest after empyema (?) .		1	Rendu et Bulloche.
Hydatid cyst (?) of lung		1	Thoinot et Delambre.
Caseous mass in right lower lobe; arte	crio-		
selerosis; cysts in brain		1	Waldo.
Malignant growths of the pleura:			
Sarcoma		4	Elliot,3 Hasbrouck,3 Saundby, Virchow.
Carcinoma		2	Ewald,3 Norrie.4
Total associated with chronic dis of lung or pleura	ease}	65	

¹ My references undoubtedly cover the bulk, though not quite all, of the recorded cases. To avoid any discussion I have arranged separately all cases in which only the clubbed fingers were present. In the celebrated cases of the brothers Hagner (Fredreich, Erb, Marie, Arnold) I have not considered the diagnosis secure, and have not included them. I also agree with Walters in excluding the cases of Murray and Verstraeten and that of Legrain quoted by him. My reason for including the other cases which were not proven secondary I have given elsewhere. An abstract of all cases reported to 1895 may be found in Walter's paper on "Osteo-arthropathy and its Relationships," which comparison with the originals has proved accurate. A clinical and radiographic study of six cases by Reynaud and Audibert I have been unable to obtain, so their cases are not included.

² Possibly syringomyelia.

³ Also pleural effusion.

⁴ Unreported case with autopsy at City Hospital, New York, hy kind permission of Dr. Van Horne Norrie.

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Cases.	
Chronic jaundiee in hypertropbie eir- 8 rhosis.	Gilhert et Fournier, 2; Obermayer, 5; Parmentier, Castaigne.
Syphilis 3	Chrétien, Sebmidt, Smirnoff.
Valvular heart lesions (uncomplicated). 2	v. Bamberger, Cases 10 and 11.
Ulcerated careinoma of esophagus 1	Hirschfeld.
Sarcoma of parotids	Clément et Posmantir, eit. by Kalindero.
-	Teleky.
Chronic dysentery	Joffroy.
Acute infectious disease: pneumonia . 1	Marie.
influenza . 1	Redmoud.
inquenza . 1	Redmoud.
Total associated with other diseases. 19	
No preceding eause :	
Patient otherwise healthy 5	Decloux et Lippmann [Lemercicr same],
	Gessler, Salles et Halipré, Stevens,¹ Van
	der Weidje aud Buringb, Boekboudt.
With subsequent disease:	
Slight bronchltis 1	Gouraud, Marie.
Spinal caries 1	Guerin,1
Sypbilis, inactive 1	Newton and Mereelis.
Pulmonary tuberculosis 1	Spillman and Hausbalter.
Total not proved secondary 9	
CASES WITHOUT ENLARGEME	NT OF THE LONG BONES.
The condition followed: Cases.	
Empyema 6	Bailly, Lefebvre, Chauffard, Moizard, 2;
	Moussons, Ruehle.
Empyema and pulmonary tuberculosis. 1	Gillet.
Empyema and bronchicetasis 1	Marfan.
Bronehiectasis 4	Jovane, 2; Marie cit. by Lefcbyre, Mübius.
Pulmonary tuberculosis with cavitics . 3	Combemale et Chatelin, Hirschfeld, Leon
	y Avalés.
Chronie bronehitis 3	Leon y Avalés.
Congenital heart lesions 2	Jovane, Variot et Chieottot, elt. by Lemereler.
Immobilization for fracture of wrists,	
later pulmonary tuberculosis 1	Combemale et Sonneville.
Cbronic jaundiee 1	Gilbert et Fournler.
Pyelonephrosis and cystitis 1	Marfan.
Uleerated carcinoma of esophagus . 1	Hirschfeld.
Arteriosclerosis; angiua pectoris 1	Vcđel.
Leprosy 1	London, eit. by Mettcuheimer.
Rachitis 1	Fischer.
Malarial eaebexia; eirrhosis 1	Abadie.

These figures are given only because the cases are found in the literature of hypertrophic osteoarthropathy. They are valueless as representing the comparative frequency of clubbed fingers in various conditions, because the common cases in lung and heart lesions are seldom reported. For a careful study of this in a series of cases the reader should consult Freytag's thesis. That clubbed fingers may also occur without known cause is proved by a patient of whom I have personal notes.

A glance at the foregoing figures is sufficient to convince one that the incidence of osteoarthropathy and pulmonary lesions is not to be made light of. The same thing was brought out by Thayer, and certainly negatives the contention of Massolongo that the relation to rheumatic conditions is closer than to lung disease.

Total

Another very evident association is with suppurative, gangrenous, and putrefactive processes, Teleky's first class. In this we find 48 of the 93 cases, a considerably smaller number than the 65 in pulmonary conditions.

If we turn to the other end of the list, we see that in 9 cases, 10 per cent. of all recorded, the osteoarthropathy was not clearly secondary to any known disease. With these I think we may place the single cases said to have followed acute pneumonia and influenza, for, were there any real connection with these very common infections, we should see osteoarthropathy with much greater frequency.

The syphilitic cases might also be explained by the hypothesis of coincidence, were it not for Schmidt's patient, who improved markedly under antisyphilitic treatment. The 8 cases secondary to chronic jaundice seem to establish a real connection. The cardiac cases of v. Bamberger, when coupled with the frequent clubbed fingers found in similar conditions, which might also show slight periostitis if studied with the same care, must be included in any attempt at interpretation.

Of the various theories adduced to explain the phenomena, Massolongo's already mentioned, Thorburn's of an attenuated tuberculosis. and the theories of trophic nervous origin have no substantiation. Von Bamberger's original hypothesis, also urged by Marie, that the process is due to the selective action of toxic substances absorbed from the suppurating or putrefying foci, has, with modifications, been the best supported. Sternberg adopts it, considering the periostitis toxigenic. Almost all the pulmonary cases, those following jaundice, dysentery, malignant growths, and syphilis, may be made to fit this explanation, if one is not too specific about the toxic agent and supposes that different poisons may have the same action. Von Bamberger uses the analogy of the effects of small doses of phosphorus on hens, a periostitis ossificans having been set up in this way by Wegner. Thayer, in the same way, compares the condition with amyloid disease, which follows chronic suppurations of bone, more rarely syphilis, chronic malarial cachexia, and malignant disease. This striking association of the one with chronic bone suppuration, of the other with similar processes in the lungs, leads me to question whether the chemical nature of the toxic substance produced in each case may not in some way depend upon a difference in the chemistry of the exudate in the two tissues. That we have to deal with a poison whose constitution is due to metabolic peculiarities of specific organisms associated with the primary lesion seems most unlikely. The absence of accurate knowledge of the pathological chemistry of exudative and necrotic processes makes any theories purely speculative.

Of experimental evidence in favor of the toxic theory we have none. Von Bamberger attempted, by rectal injections of the sputum from cases of bronchiectasis, to reproduce the lesions in dogs; but, after a six weeks' trial without result, he desisted. So far as I know, no other endeavor has been made along this line.

Besides the toxic factor, however, I think more stress must be laid upon local circulatory conditions than has usually been done. That prolonged venous congestion is the cause of the ordinary clubbed fingers is usually conceded. The most striking instance of its effect is the case reported by Béclère in 1901. The patient developed typical Hippocratic fingers on the right hand, with aneurism of the third portion of the subclavian artery on that side. The pressure on veins was not sufficient to cause ædema or change of color when quiet, but, on use of the arm, the hand became cyanotic. The left hand was perfectly normal.

That stasis also leads to augmented growth of bone is a fact utilized at times in surgery (Krause, etc., cit. by v. Bamberger) This is probably the main factor in the production of the slight periostitis of v. Bamberger's two cardiac cases, as he himself believed. I also consider that it is an accessory one in the advanced osteoarthropathies of empyema, bronchiectasis, lung cavities, malignant growths of the lung, and deformities of the chest due to spinal caries, etc., for, in all these conditions, peripheral stasis is more or less in evidence. Such stasis would lead to a concentration of the circulating toxic products at the distal portion of the extremities and, by making conditions there most favorable for chronic inflammatory changes and bony growth, help to explain the apparent selective distribution of the lesions. In long-standing icterus with hypertrophic cirrhosis the toxic agent must derive its origin from altered metabolic activities, and here, too, circulatory changes may assist.

When we come to the consideration of the apparently primary cases, in some of which the phenomena have been claimed by the patients to have existed since birth and to have been present in other members of their family, we must either beg the question or postulate some peculiar susceptibility of the osseous system to slight toxic influences. That great individual differences in the reaction of the bones to irritants exist in different persons is evident from the varying time required for the repair of fractures.

Two observations remain to be mentioned as bearing on the etiology. Hirschfeld found a marked interstitial neuritis at antopsy in three cases, with extreme enlargement of the hands and feet, two of them also showing the characteristic osteoperiostitis. The pain in these cases had been severe and they showed considerable variation in the size of

¹ Freytag: Two cases, each of which had healthy father with clubbed fingers. Fraentzel: A healthy daughter had clubbed fingers. Decloux and Lippmann; Sister said to be the same. Newton and Mercelis: Healthy brother said to be the same.

the members at different periods. He considered this due to vasomotor influences dependent on the neuritis, and proposed the term "dermatohypertrophia vasomotoria" to describe it. This seems to me one of those "Bandwürmerworten," inveighed against by Virchow, which may be spared. To this interesting finding must be added that of Möbius, who saw, in a case of well-marked clubbed fingers occurring in a patient with bronchiectasis, an extreme enlargement of the ends of the two ulnar fingers follow an ulnar neuritis.

In closing I would urge the necessity for the careful recording of cases of osteoarthropathy and allied conditions by radiographs, that at least the chronological sequence of the lesions may be firmly established. This much may be done by the clinician. The problem of the true etiology, I believe, awaits a larger knowledge of bone pathology and of pathological metabolism than we now possess.

For the radiographs accompanying this article my thanks are due to Mr. E. W. Caldwell, Director of the E. N. Gibbs X-ray Laboratory of the University and Bellevue Hospital Medical College.

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AN HOUR-GLASS STOMACH OBSERVED IN SITU.

BY THOMAS DWIGHT, M.D., LL.D., PARKMAN PROFESSOR OF ANATOMY AT THE HARVARD MEDICAL SCHOOL.

THE examination of a series of frozen sections through the trunk of a male subject, which were made during the past winter, revealed a very remarkable hour-glass stomach. Perhaps the description of the organ may be of clinical value, for, so far as I know, this condition had never been observed in situ; that is, in a hardened body, as it must be if true ideas are to be gained of its shape and relations. Moreover, this specimen offers suggestions as to the etiology of the condition which if not new have at least been lost sight of, and calls attention to peculiarities of muscular action which at least are not generally recognized.

The body was that of a white man, aged sixty-six years, fairly well nourished. He died rather suddenly, probably of cerebral hemorrhage, about three months after his admission with a septic foot into a pauper institution. There is no record of any gastric symptoms. It appears from the frozen sections that the heart was dilated, especially on the right, and that the tricuspid valve was insufficient. The great veins near the heart were very much distended, but this may have been exaggerated by the venous injection.

The body was injected with a 10 per cent. solution of formalin and frozen. Sections were kept for a week or so in formalin before being

transferred to alcohol. I would say, in passing, with regard to the technique, that could I command at pleasure a temperature of below zero (Fahrenheit), and were the sections once cleaned and mounted never to be touched again, I would have nothing to do with so disagreeable an agent as formalin; but it takes to a great extent the place of cold and adds much to the toughness of the slices, which is very useful if they are to be handled. Fig. 1 shows the general shape of the stomach, being from a photograph of a cast of the interior seen almost directly from above. Figs. 2 to 5 represent the upper surface of four successive slices. Fig. 6 is a view of the cast from the right and from behind. The cast is mounted as nearly as possible in the position it occupied in the body.

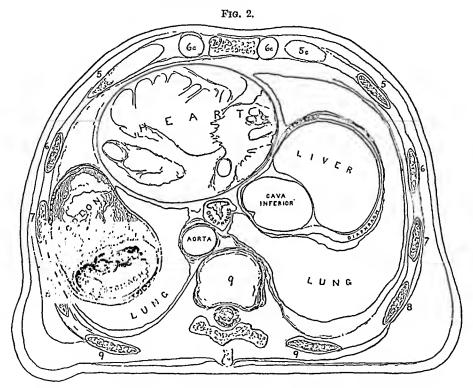
Fig. 1.



Cast of the inside of the stomach, seen almost directly from above. The anterior pouch is at the top; the posterior, with the esophagus, is below. The black line indicates the median line of the body.

The æsophagus passes the diaphragm opposite the tenth thoracic vertebra in the thickness of the slice, the top of which is shown in Fig. 2, and is seen with the diaphragm still near it at the disk below the tenth vertebra in Fig. 3, running almost horizontally to the left and expanding, trumpet-like, into the stomach (Fig. 6). The mucous membrane does not show clearly the change from the æsophageal to the gastric kind; but this probably occurs nearly opposite the star in Fig. 3. The fundus then rises on the left and ends in the thickness of the slice above that shown in Fig. 2, near the top of the ninth thoracic vertebra and a little below the level of the left nipple, which in this body is opposite the fourth intercostal space. This upper division of the stomach (Fig. 2) is nearly oval on section, the anterior and posterior walls being nearer than the borders. Of these walls the former looks decidedly to the left and the latter to the right. The very

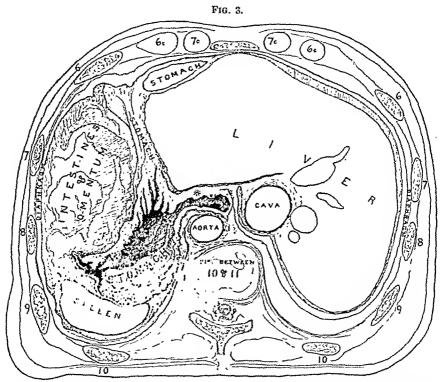
summit of this division in the slice above that shown in Fig. 2 was, unfortunately, lost. Having no attachment to the part of the diaphragm just against it, there was nothing to restrain it, and it fell out of place and was overlooked. Happily there were means by which its shape could be approximately determined so as to justify its representation in the cast. The lowest part of the upper division extends downward to opposite the top of the twelfth thoracic vertebra, and then passes into the narrow passage connecting the two divisions. In Fig. 3 we see the upper surface of this narrow passage running forward, expanding and rising, so that in this section a part of each division is shown. The lumen of the constricted portion appears in Fig. 4. Its beginning is best shown in Fig. 3. It is a little behind a transverse



Section at the ninth thoracic vertebra through the upper part of the superior pouch.

vertical plane touching the front of the aorta. The posterior part of the apparent tube shown in Fig. 4 is somewhat behind this and therefore belongs to the first division. The position of the anterior end of the constriction is fairly well shown in Figs. 3 and 4. The measurements of the constricted portion are not very satisfactory, owing to the difficulty of choosing definite limits. The upper border measures about 7 cm. and the lower about 5 cm. The length of the left side may be called 7 cm. and that of the right only 4 cm. Its greatest diameter is from above downward. It is broadest below and would admit a forefinger easily. The very highest part of the inferior division is shown in Fig. 3, opposite the left sixth and seventh costal cartilages near the sternum. This division lies against the abdominal walls in the angle between the eighth costal cartilages, and narrows

gradually to the pylorus without any distinct antrum pylori. Fig. 5 shows a part of the pyloric thickening, but gives an erroneous impression of a tubular pyloric portion. The pylorus itself was constricted, but it could easily be dilated to permit the passage of an instrument nearly or quite 1 cm. in diameter. It is placed very far back, within less than one inch of the inferior cava, so that the pyloric portion usurps the place of the first part of the duodenum. The opening is opposite the lower part of the twelfth thoracic vertebra, a little above the plane of Fig. 5, and points directly backward. The general shade and position of the organ are best seen in Figs. 1 and 6. The former gives a good idea of the relative size of the component parts and of the relation of what might be called the long axis of the stomach to



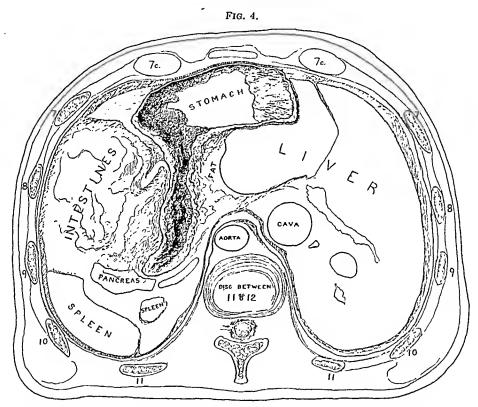
Section at disk between the tenth and eleventh thoracic vertebræ opening both pouches and passing above the tubular portion. The star indicates the passage of the æsophagus into the stomach.

the median plane of the body. The latter shows the general direction of that axis in reference to a horizontal plane.

We may sum up as follows: There are two sacs, of which the inferior is decidedly the larger, connected by a narrow tube. The esophagus ends nearly horizontally in the superior pouch, which then ascends backward and to the left. The constriction begins at the level of the cardiac opening; it extends forward and somewhat downward, though its under side rises in the middle and empties into the lower or anterior pouch, the top of which is slightly above the level of the lowest part of

the former. The course of the long axis of the stomach may be divided into three parts: The first is downward and somewhat forward, the second almost directly forward, and the third approximately horizontal and transverse. It is worthy of remark that the common axis as a whole might be said to be essentially from behind forward. We shall notice later Birmingham's views on this point.

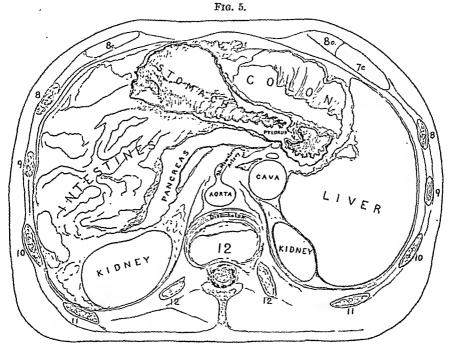
As to the relations of the stomach, there is not much to say that could not be inferred. The line of the attachment of the great omentum to the stomach is very hard to follow. Apparently it passes behind the fundus in the slice shown in Fig. 2, runs along the left side of the con-



Section at disk between the eleventh and twelfth thoracic vertebre through the lowest part of the superior pouch, the tubular portion, and the upper part of the inferior pouch.

stricted part, is continued along the lower border of the transverse part shown in Fig. 5, and ends at the right of the pylorus. The course of the lesser omentum is not to be made out. The great omentum, which covers the structures well named by Birmingham the stomachbed, is not to be recognized. The relations of delicate membranes are not easily followed on frozen sections. The left crus of the diaphragm indents the posterior wall at about the end of the esophagus. The spleen lies behind and external to the upper pouch. The compensatory relations of the colon with the stomach are well shown. The splenic

flexure rises to the left of the upper pouch. A thick fold of mesentery (probably going to the jejunum) lies against the left of the constricted part, interposing between it and the transverse colon, which reappears beneath the lower pouch. As the latter narrows and passes obliquely backward to the pylorus, the transverse colon lies before it. The bend in the lower wall of the constricted portion is caused by the pancreas, over which it passes. The constricted portion above corresponds very closely to the border of the left lobe of the liver, which is between it and the heart. The second pouch is, of course, covered by the liver, the quadrate lobe covering the pyloric portion. The first portion of



Section at the lower part of the twelfth thoracic vertebra, near the bottom of the inferior pouch and just below the pyloric opening.

the duodenum is reduced to next to nothing, the gut descending immediately.

We now come to the most interesting part with regard to the cause of this condition, namely, the walls of the stomach. The thickness of the walls varies very much. They are thinnest at the back of the first pouch, where the wall is probably less than 1 mm. through. The front part of this portion is much thicker than the rest (Fig. 2), and this thickness extends into the constricted portion, being greatest above and on the left. The lower and right sides are less markedly thickened, but they exceed the thickness of the dilated portions. Probably the thickest part of all is where the front of the upper pouch passes into

the top and left of the tubular portion. The beginning of this part is thicker than its end. The thickening of the pyloric part, as shown in Fig. 5, is more apparent than real, owing to the section striking the wall obliquely near its upper part. There is, however, the usual ring at the pylorus.

The mucous membrane is very smooth throughout the lower pouch except for a series of folds in the last inch converging to the pylorus. The upper pouch presents many irregular folds. (It is to be remembered that the very summit, unfortunately, was lost.) The anterior wall of this pouch is covered by a network of folds, to which the cast fails to do justice. These increase in size as they reach the tubular portion, which presents a great abundance of large longitudinal folds, especially in the upper two-thirds of its cavity. They are most developed in the first part of the tube and make a great puckering into the upper pouch (Fig. 3). The highest folds, which are in the constricted portion,



Fig. 6.

Cast of the inside of the stomach, seen obliquely from the right and behind. It shows approximately the inclination of the long axis of the stomach. The star marks the place of the pylorus.

measure 1 cm. or more from base to summit. There are no traces of ulceration or of any disease in any part of the mucous membrane, but the great folds give the impression of the tubular part having been squeezed.

The serous membrane covering the stomach presents in some places a very peculiar appearance. It seems to be filled with minute indentations, which on closer examination often resolve themselves into narrow, longitudinal depressed lines or creases. Sometimes both coexist, and the whole effect is sieve-like. I imagine that tissue like this has been

described as cicatricial, but there is no justification for that term. The peritoneum follows the irregularities of the surface and is quite free from adhesions or other signs of inflammation. This appearance is limited pretty closely to the regions in which the walls are thickened and the folds of mucous membrane exuberant. It descends along the front of the upper pouch onto the top of the first half of the tubular part. It encroaches but very slightly on the second pouch, being found to a small extent on the left of the region shown in Fig. 4, just at its beginning. This portion, however, is insignificant.

Dr. George B. Magrath, of the Harvard Pathological Department, was kind enough to examine microscopically a piece taken from the front wall of the upper pouch a little above the tube, which combined thickness of the wall, redundancy of the folds, and the peculiar appearance of the outer surface. Of course, such a specimen was ill-suited to microscopic examination, as the stomach must have been far from fresh before any hardening agents were used. Dr. Magrath accordingly reported that the mucous membrane showed great post-mortem changes, that glands were to be recognized only here and there, but that the connective tissue between these glands was somewhat hyperplastic, containing more than the ordinary number of cells. The submucosa contained considerable fat tissue, but showed nothing pathological. There was some hypertrophy of the muscular tissue, especially (perhaps solely) of the outer layer, the enlarged aggregations of which gave the surface of the specimen its honeycombed appearance. In a few places there was more connective tissue than is normal between the muscular layers. The serosa showed no signs of thickening in the few places in which it was apparent. I am not aware that a similar microscopic observation has been made on an hour-glass stomach. In spite of its shortcomings, from the nature of the specimen, it is valuable as showing, in addition to an hypertrophy of the muscular tissue, a tendency to hyperplasia by which greater stability is given to the walls.

Among the reasons for which this specimen is valuable may be mentioned the light it throws on the position of the stomach. It is now recognized that the lesser curvature of the stomach is essentially vertical and not transverse; but what is not generally recognized is that the stomach has a very strong forward inclination, and that when empty this may be so great as to make the main axis almost horizontal from behind forward. This is well stated by Professor Birmingham in Cunningham's Text-book of Anatomy. He emphasizes also the very important fact that during life hollow organs with muscular walls are not flaccid when empty, but more or less contracted. I have reconstructed another stomach from frozen sections which, without being an hour-glass, was of a shape that would be utterly incomprehensible

to one whose ideas were formed by the older descriptions. It was of small capacity, having been, presumably, nearly empty. It lay nearly horizontally. While the whole organ was in a more or less contracted state, the fundus was puckered up into a separate pouch. Birmingham's dissections of the muscles of the stomach show that there is a whorl over the fundus, which he derives from the innermost layer. My own dissections have inclined me to believe that it is made essentially by the middle or circular layer. As there is more or less intermingling of the layers, it is of little importance which of them predominates; but the contraction of the circular fibres at the periphery of the whorl would account for the puckering of the fundus into a pouch, which is to be observed also in this specimen.

Doubtless there are many causes of hour-glass stomach; in other words, all cases are not of the same nature. We are told that it may be congenital; but, so far as I am aware, there is only one case of a bilocular stomach on record in a fœtus or young child-that of Sandifort1 in a fœtus. Dr. F. S. Watson,2 in his excellent paper, classes many as congenital without, as it seems, sufficient grounds. Thus he subdivides all cases into congenital and acquired, the former being marked by the symmetry of the constriction and the absence of pathological processes connected with it. He considers this latter the only positive evidence of its congenital nature. He believes that the acquired cases are generally due to cicatrices from ulcers, or to fresh ulcers, or to adhesions to other organs, etc. He disregards the contractions that occur in the course of digestion. Excellent work has comparatively recently been done on the movements of the gastric walls during digestion by Dr. W. G. Cannon³ and others, but it is interesting that the occurrence of rings of contraction was known to Sir Everard Home' nearly one hundred years ago. He speaks of finding bands in empty stomachs and not always in the same place. Thus they may be at the middle or nearer the pylorus. He insists on the necessity of making the examination soon after death. He made similar observations on animals with simple stomachs. Struthers and others have since alluded to them. Such constrictions can be broken down by more or less pressure of injected air or fluid. Allusion has been made to a constriction becoming fixed or chronic, and this seems to me precisely what has occurred in this instance. The most remarkable feature of this stomach is the length of the narrow part. I am not clear that such another has been described. According to Dr. Watson's classifica-

¹ Obs. Anat. Path., Tome iii. p. 11. 2 Annals of Surgery, 1900, vol. xxxil.

³ American Journal of Physiology, 1898, vol. i.

⁴ Observations on the Stomachs of Different Animals, etc., Phil. Trans. for the year 1807, vol. xevil. p. 139.

⁵ Monthly Journal of Medical Science, Edinburgh, 1851, vol. i. p. 121.

tion, this must be called congenital; but I do not so consider it. A contraction has somehow become chronic and then consolidated. There is no apparent disease of the mucous membrane, and certainly no inflammation or adhesion of the surface. How this happens I am not prepared to say. No one who-has seen the specimen would for a moment admit that any amount of insufflation would overcome the constriction. The fact that it can be overcome in certain cases, but only with considerable difficulty, seems to indicate that there is an intermediate condition between an ordinary transitory contraction and consolidation. There are at least two other places where similar phenomena are observed; one, in fact, is in the same organ. I refer to the occasional appearance of the pyloric portion as a tube with very thick walls. I have observed this also in a series of frozen sections. The appearance of an inch or more of the stomach was that of a piece of small intestine, only with far thicker walls. It was not conceivable that it depended on any transitory contraction of the muscle. seemed precisely as fixed as in this case. The other region is that of the descending colon, which is sometimes found contracted into a very small tube presenting a series of swellings. This condition may be found associated with irritation of the bowels and also when everything is apparently normal. It is presumably in many cases nothing but the normal contraction of an empty organ with muscular walls; on the other hand, it is sometimes so firm that it is hard to believe it is not permanent. It is further to be said in support of this view that this case was not congenital, but the result of muscular contraction; that in the former hypothesis one would not expect to see the great folds of mucous membrane in the constricted portion, which declare eloquently the effect of constriction.

It has been shown that in digestion waves of constriction pass along the stomach, and are most definite near the pylorus, where, when they become fixed, they no doubt make the single, the double, or even the triple antrum pylori, the last of which was mentioned long ago by Retzius. I have seen reason to believe that not rarely there is a slight indication of a narrowing at the middle of the stomach. While it cannot be doubted that hour-glass stomach may be due to ulceration and cicatrices, it is not at all clear how these under ordinary circumstances can cause a circular constriction unless, as is most probable, the irritation produces a contraction of the circular fibres, which become set. Until we see more cases of hour-glass stomach at about the time of birth it is impossible to admit that it is congenital except very rarely. There is no convenient way of accounting for it as a reversion. Indeed, it is much more scientific to ascribe its origin to a

phenomenon of contraction natural to a hollow muscular organ in any animal than to have recourse to the doctrine that the exceptional occurrence of some peculiar condition in man is *explained* by its being normal in the black bear or the white whale.¹

AN OPERATION FOR THE REPAIR OF THE PELVIC FLOOR.

By J. G. Mumford, M.D.,
ASSISTANT VISITING SURGEON TO THE MASSACHUSETTS GENERAL HOSPITAL.

At the present time it seems as though this subject, the cure of ruptured perineum, had been exhausted, because numberless surgeons have devised numberless operations for the repair of the lesion. My object in presenting this communication is to demonstrate an operation simple and effective and applicable to conditions from the most trifling to the most severe.

Long ago Mr. Tait performed an operation by which he succeeded in closing the vaginal outlet without any sacrifice of tissue; but his operation was very limited in scope and was ineffective as a repair of the pelvic floor. Taking Tait's operation as a point of departure I have elaborated a procedure which I have found useful and satisfactory in all routine cases, not only for the repair of the torn perineum, but also for the relief of cystocele and rectocele.

It seems hardly necessary to refer in detail to the anatomy of the region involved, but a few words of explanation are necessary.

The first muscle to be considered is the constrictor vaginæ, which with the sphincter ani goes to make up the rather delicate encircling portion concerned in these lacerations; closely associated with these muscles are the transverse perineal muscles with their attachments to the tuberosities of the ischia. The true pelvic floor, however, is the levator ani, and when this is extensively damaged the most serious displacements follow.

It is obvious that a laceration of these muscular structures not only destroys the inferior supports of the uterus, but of the bladder and rectum as well; especially when the mucous membrane of the vagina is much involved. The prolapse of the bladder and rectum has been

¹ Dr. Bettmann gives a very good bibliography in his prize essay, The Shape and Position of the Stomach, Phil. Monthly Med. Journ., March, 1899. Dr. Watson reproduces in his paper the part relating to hour-glass stomach. I beg leave to point out one inaccuracy and to supply one omission. In the reference to Home's paper the pages are given as 170, 171. The reference on those pages is in an abstract of the papers published in the Transactions. The proper reference is as I have given it. On account of the little-known publication in which it appeared a very excellent paper by Prof. B. C. A. Windle on Sacculation of the Stomach has been overlooked. It is in Proc. Philosoph. Soc. of Birmingham, vol. vi.

happily described as a form of hernia, which, indeed, it is; and various operations have been devised to retain such herniæ and hold these organs in their normal position. The method of all such operations is to restore the injured muscles, and as a preliminary to this the denuding of various parts has been employed. The procedure which I shall describe demonstrates successfully, I believe, that denuding operations are needless. All operations for extensive repairs in the pelvic floor are based upon the need of restoring the continuity of the levator ani muscle. Commonly this muscle is reached and sutured by removing considerable areas of overlying membrane and cicatricial tissue; this involves a tedious dissection in a region which is disinfected only partially and with difficulty, so that the results are never certain and the repair frequently imperfect.

By the method which the following sketches illustrate it will be seen that no tissue is sacrificed, that all the work is subcutaneous, and that the deep parts are quickly and easily reached.

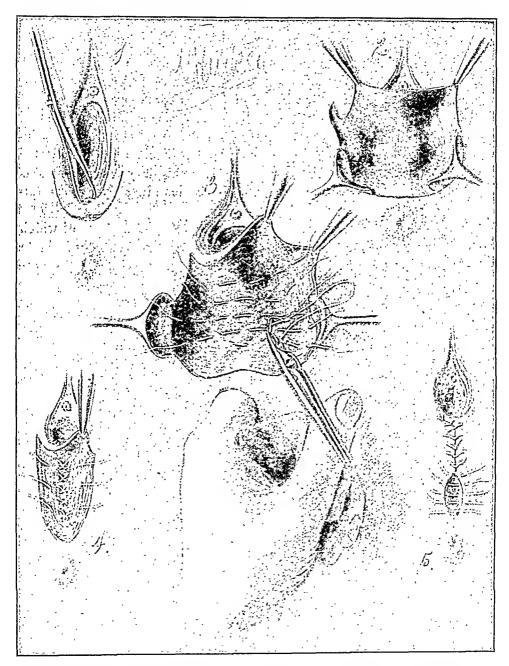
No. 1. shows the first step in this operation, which may be described, for convenience, as a septum-splitting operation. The skin is cut through so as to open a crescentic incision between the vaginal outlet and the anus, and No. 2 shows how the dissection may readily be carried back so as to separate the rectum from the vaginal wall as far up as the posterior cul-de-sac; the finger in the depths of the wound lies against the cervix, no matter what the height of the uterus may be; the outline of the cervix is indicated in the sketch.

This dissection may be done rapidly after some little practice, for after cutting through the superficial cicatrices the high separation may be made with the finger; if care be not taken there is danger of perforating the rectum, but this may be avoided by clinging to the vaginal surface. Even if the rectum be penetrated the resulting wound seldom leads to trouble or interferes with the result. The greatest difficulty, if difficulty there may be said to be, is the sometimes copious bleeding from hemorrhoidal veins. Such bleeding must always be checked, else it leads to hematoma and infection; but even in those few of my cases in which the rectum had been perforated no serious trouble has followed. The depths of the wound have, indeed, been infected, some sloughing and abscess formation has occurred, but the integrity of the newly built structure eventually has not been damaged.

No. 3 shows somewhat imperfectly how widely the buried catgut stitches may be carried into the deep parts. The three upper stitches in the sketch are passed through the levator ani fibres and may be sunk freely, and without risk of damage, to any desired depth, the needle being readily carried out to the tuberosities; the two or three lower stitches grasp the severed superficial muscles and the last stitch of all takes up the fibres of the sphincter ani. By this method of stitching

the most extensive lacerations may readily be repaired, as must be obvious from a glance at the illustration.

When these deep stitches are tied the very stout and broad perineal floor is formed, as is shown in No. 4. A second row of buried stitches



is then passed, and finally the skin wound is drawn together, as in No. 5. It is obvious that the size of the vaginal opening may be made as small as desirable, and in the case of elderly women with extensive herniæ this orifice is made very small indeed.

It would seem that enough has now been done to correct the cystocele and rectocele, and usually this is indeed the case; but if we have to deal with a uterus with elongated cervix and damaged anterior and posterior supports, that cervix may still force its way through the smallest vagina. For such reasons it is sometimes necessary either to amputate the cervix or to fix the fundus of the uterus to the abdominal wall or to perform both operations. In a number of cases in which this complicated operation has been done the functional results have been extremely satisfactory.

In the case of young women in the childbearing period the newly formed perineal body has been found to act in a very normal fashion; it stretches surprisingly before the descent of the fætal parts, and in the three cases in which I have watched it it has neither proved too resistant nor has it suffered from extensive secondary laceration, as is seen so frequently after the performance of denuding operations followed by labor.

I have a list of forty of these flap-splitting operations, thirty of which were done at the Massachusetts General Hospital and ten in private practice. Of the thirty hospital cases, the immediate results were invariably so excellent that I have been prompted to make this brief report and description of the manœuvre. Eleven of them were in cases of young women and nineteen in women who had passed the menopause. Fourteen have been traced, and the reports from the patients express satisfaction.

Of the ten private cases, three were in young women who have since borne normal children and in a satisfactory manner. The remaining seven cases were those of older persons, who suffered more or less severely from pelvic herniæ. In none of the cases was there done any denuding of the bladder or rectum walls. In four of them the uterus was fixed anteriorly; the anatomical and functional results have been good.

TWO CASES OF LEFT DUODENAL HERNIA, IN ONE OF WHICH THE SAC CONTAINED THE ENTIRE SMALL INTES-TINE, THE CÆCUM, AND A PORTION OF THE COLON, WHICH WAS STRANGULATED.¹

By Leonard Freeman, M.D., of denver, colorado.

THE abdominal viscera and peritoneum are subject to various malformations and malpositions, sometimes acquired and often congenital. They were formerly regarded as mere anatomical or pathological curi-

¹ Read before the American Surgical Association, Washington, May 14, 1903.

osities, but with the growth of abdominal surgery they have acquired a new significance. This is especially true of the peritoneal fossæ and of the irregularities in form and position of the colon, cæcum, and vermiform appendix. Unless the surgeon be familiar with these unusual phenomena his diagnostic ability will be curtailed, and he may at any time be confronted by confusing conditions for which he can find no adequate explanation.

The peritoneal fossæ, for instance, may be responsible for the most remarkable forms of hernia, involving at times the entire bowel, and leading to great perplexity in diagnosis and surgical treatment in case of strangulation. This is particularly true of the duodenal fossæ.

Although the duodenal fossæ were described as early as 1776 by Neubauer, their importance was first pointed out by Treitz in 1857, who described their anatomical peculiarities with accuracy, and emphasized the fact that both small and large herniæ occasionally developed within them.

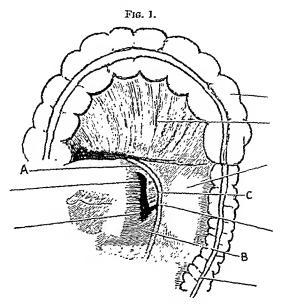
The duodenal fossæ lie opposite the third lumbar vertebra, where the duodenum emerges from the transverse mesocolon. They are formed by folds of peritoneum attached to the duodenum. If, in the cadaver, the abdomen be widely opened by both longitudinal and transverse incisions, and the colon pulled upward so as to put its mesocolon on the stretch, while the mass of small intestine, with its mesentery, be thrown over to the right, one or two more or less well-defined folds of peritoneum may often be seen fastened to the duodenum near the point where it merges into the jejunum. Rarely are they attached to the jejunum itself. These folds form the borders of corresponding peritoneal fossæ, which were formerly called duodenojejunal fossæ (Treitz); but, seeing that they are more intimately connected with the duodenum than with the jejunum, the term duodenal fossa is preferable.

To assist in gaining a clear idea of the situation, one can imagine that the lower portion of the duodenum has been pushed, as it were, through the posterior parietal peritoneum at the base of the transverse mesocolon, dragging with it attachments of the peritoneum or mesocolon, or both, which necessarily form folds. If it is the mesocolon, the fold will have its sickle-shaped concavity toward the pelvis, the resulting fossa extending toward the diaphragm; while, if the posterior parietal peritoneum is concerned, the concave border of the fold will be toward the diaphragm, the fossa bulging toward the pelvis. The former condition gives rise to the superior duodenal fold and fossa (Fig. 1, A), while the latter causes the inferior duodenal fold and fossa, sometimes designated the "fossa of Treitz" (Fig. 1, B).

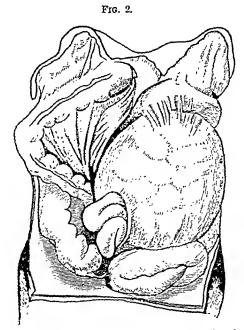
In addition to these two principal folds, others of minor importance

¹ Hernia Retroperitonealis, Prague, 1857.

may exist, especially an intermediate one. All of them may be present at once, or any of them may occur singly. They may be so poorly



A, superior duodenal fold; B, inferior duodenal fold; C, inferior mesenteric vein. (Juvara.)

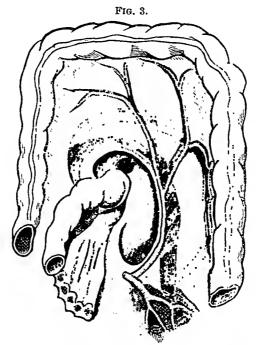


Treitz's case of left duodenal hernia. (Moynihan.)

developed as to escape all but the closest observation, or they may be so prominent as to form deep, well-marked pockets.

The inferior mesenteric vein encircles the left border of the duodenal fossæ, generally passing quite close to it (Fig. 1, C). The left colic artery is usually found more externally. These vessels form the so-called "arch of Treitz." They are a source of danger if an attempt is made to incise the neck of the sac when strangulation is present.

It has always been taught that left duodenal hernia—one in which the sac develops beneath the posterior parietal peritoneum principally to the left of the median line (Fig. 2)—almost invariably occurs in connection with the inferior duodenal fossa; but with this Mr. Moynihan does not agree. He believes that another fossa, which occasionally appears somewhat external to this, is responsible. This he designates



Paraduodenal fossa or fossa of Landzert. (Moynihan.)

the "paraduodenal fossa" or "fossa of Landzert." It is formed by a fold of peritoneum (plica venosa), elevated by the inferior mesenteric vessels (Fig. 3). His main argument is based on the fact that the mouth of the hernial sac is always vascular. This argument, however, seems open to question—in the larger herniæ, at least—as it would require but little stretching of the opening to bring the inferior mesenteric vein in such intimate relation with the mouth of the sac that accurate differentiation would be impossible.

Mr. Moynihan, in his excellent monograph, has collected fifty-eight cases of left duodenal hernia, thus showing that, although the affection is sufficiently uncommon, it is not so rare as was heretofore supposed-

¹ Retroperitoneal Hernia, London, 1899.

Strangulation, however, seldom occurs, Jonnesco having found mention of but eight cases in the literature of the subject.

Some time ago it was my fortune to meet with a strangulated left duodenal hernia in a strong, well-developed man, aged forty-seven years, an American by birth, and a miner by occupation. He had always enjoyed good health, except occasional slight indefinite abdominal pains. Following an attack of diarrhea lasting three weeks he suddenly developed, four days before I saw him, a severe ileus, with the usual symptoms of acute intestinal obstruction. An operation was at once performed. The pulse was then 120 and unsatisfactory in quality, the temperature subnormal, and the capillary circulation poor.

On opening the abdomen we were surprised to find the cavity occupied by an immense tympanitic tumor resembling an ovarian cyst, which could be outlined on each side and below by passing the hand between it and the abdominal walls. The small intestine was nowhere to be seen, but the colon could be felt below and to the right side. After some deliberation we opened the tough, membranous sac, within which was found the entire small intestine, together with the cæcum and some six or eight inches of the adjacent colon. There was also considerable foul and bloody serous fluid, no trace of which existed outside the sac, showing how completely the inner cavity was separated from the outer.

The cæcum, which was distended with fluid feces to the size of an infant's head, and largely gangrenous, lay in the left upper quadrant of the abdomen, just beneath the spleen, in the vicinity of which the swollen appendix was attached by recent inflammatory adhesions. Several inches of the large intestine near the cæcum were also gangrenous. The cæcum and neighboring colon possessed a very long mesentery, which rendered them freely movable.

In tracing the colon from below upward it was seen to emerge from the small pelvis upon the left side, as usual, and then pass directly across the lower portion of the abdomen, coiling itself loosely in the right iliac fossa and right lumbar region, outside the sac containing the small intestine. It then entered this sac through an opening on the right side posteriorly, and, passing beneath a portion of the small bowel, ended in the execum in the superior lumbar region on the left side. The colon was strangulated at the point where it entered the sac.

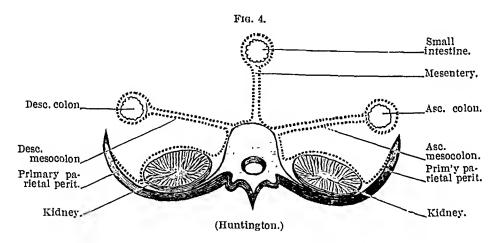
In attempting to relieve the condition it was necessary to resect the gangrenous execum, together with some six inches of the large intestine and a considerable portion of the small bowel. In doing this the gut was crushed with an angiotribe, the cut ends invaginated, and the opening closed with an over-and-over suture. A side-to-side anastomosis was then made with a Murphy button between the lower end of the ileum and a loop of colon in the right iliac fossa.

The patient's resisting powers were so poor, and the operation was

so complicated and extended, that death resulted. No autopsy was obtained, but the abdomen had been so freely opened that the condition was evidently as described.

This case seems, in some respects, unique. In no other instance, so far as I am aware, has any portion of the colon been found within the sac of a duodenal hernia; in fact, several writers state specifically that the colon invariably remains outside, as though this were an important characteristic of this form of hernia. This nuusual feature is easily accounted for, however, by the mesentery of the execum and colon being of abnormal length.

Another anomalous condition is to be noted in the fact that the entire colon lay in folds upon the right side of the abdomen instead of encircling the hernial sac, as was to be expected. Such a malposition is



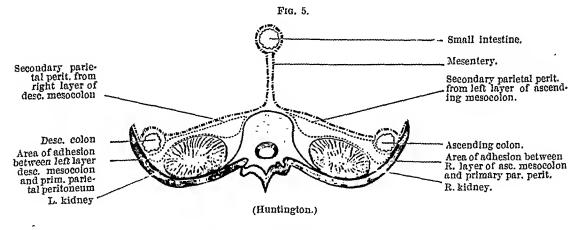
usually congenital, as I at first imagined it to be in this instance, and arises from rotation of the umbilical loop during feetal life in a direction contrary to the normal, thus carrying the whole large bowel over to the right side, beneath the mass of small intestine instead of above it. This, however, is probably not the correct explanation in the present It is more likely that the excum and colon originally possessed an exceedingly long mesentery (Fig. 4), and that adherence of the descending colon in the left lumbar region failed to take place as it normally should in the course of the development of the individual The attachment of such a mesentery would be near the centre line of the body, close to or identical with that of the mesentery of the lesser bowel. Under these circumstances it can be imagined that the duodenal fossæ might be present to even more than the average extent, because of the looseness of the mesocolon, which normally is so firmly adherent to the posterior parietal peritoneum as to practically form part of it.

Hence if a duodenal hernia should occur, as it would probably have

an exceptionally good opportunity of doing, the sac would have a tendency to develop to the left of the large bowel instead of to the right of it, thus displacing the descending and transverse colon to the right side of the abdomen, providing the hernia were of large enough size.

In the formation of a postperitoneal hernia such as the one under consideration, the duodenum enters the opening first, dragging after it the jejunum and then the ileum with their mesentery. The cœcum, being attached to the lower end of the ileum, would enter last. As the mouth of the hernia is situated toward the posterior aspect of the sac, the cœcum would be apt to pass beneath the greater portion, at least, of the small bowel, as was the case in the present instance. Strangulation of the colon would be quite likely to occur owing to stretching of the mesenteric vessels and pressure against the sharp edge of the sac.

The fact that the colon alone was found to enter the sac, without any portion of the small intestine being present in the opening, seems



at first a little confusing unless we remember that the duodenum passes beneath the peritoneum to the duodenal fossa, so that when a hernia is formed the remainder of the bowel is dragged through the opening into the space where the duodenum already lies. Hence only that portion of the bowel which has been pulled in, so to speak, can pass through the hernial opening. This condition, which is often found, to say the least, would seem to contradict the opinion of Moynihan that duodenal herniæ almost invariably occur in the paraduodenal fossa beneath the plica venosa, as this would necessitate the entrance of the duodenum into the general peritoneal cavity before it could enter the sac (Fig. 3), which would lead to two sections of bowel being found in the opening instead of one.

Since writing the above I have encountered, during an autopsy, a second case of left duodenal hernia. The patient died from gangrene of the small intestine, accompanied by severe hemorrhage (stomach and

bowels), arising from thrombosis of the mesenteric and portal veins, which in its turn was dependent upon a "hobnail liver." The hernia was apparently in no way concerned with the fatal issue.

The individual was an exceptionally strong and well-developed man, aged forty-seven years, who had always enjoyed good health. He had been subject, however, to indigestion, and occasionally experienced slight pain and uneasiness in the abdomen.

The sac filled the entire left side of the abdominal cavity and pushed well over to the right of the median line. It contained all but six inches of the small intestine, the transverse and descending colon being spread out upon its upper and left outer surface, leaving the ascending colon and execum in their normal position. The mouth of the sac was round and smooth and easily admitted three fingers. From it emerged the lower end of the ileum to join the execum in the right iliac fossa. The opening was just to the right of the vertebral column, on a level with the crest of the ileum and toward the dorsal and inferior portion of the sac. Its free ventral border was occupied by the inferior mesenteric vein, while the left colic artery ran much further to the left, along the posterior abdominal wall.

The small intestine, which appeared to be unusually short, was arranged in regular parallel folds, like a Mikulicz drain, running from the left below to the right above. The omentum was short and thick and pushed to the right side above the sac. There was no strangulation of bowel or mesentery.

RARE CASE OF APPENDICULAR ABSCESS SITUATED BETWEEN THE LAYERS OF THE MESENTERY OF THE SMALL INTESTINE.

APPARENTLY DUE TO A PERFORATION BETWEEN THE BASE OF THE APPENDIX AND CÆCUM BY A ROUND WORM. FIRST OPERATION, DRAINAGE. SECOND OPERATION FOR OBSTRUCTION IN TWENTY-SEVEN HOURS. ENTEROSTOMY. STARVATION DUE TO HIGH POSITION OF FECAL FISTULA. THIRD OPERATION, SIX WEEKS. INTESTINAL ANASTOMOSIS.

RECOVERY.1

By Joseph C. Bloodgood, M.D., of Baltimore, MD.

I BRING this patient before the Society because of a number of rare and interesting features in a very complicated attack of appendicitis. It is the first definite localized abscess which I have

¹ This patient was exhibited before the Medical and Surgical Section of the Medico-Chirurgical Faculty of Maryland, Friday, February 20, 1903.

observed to be situated between the folds of the mesentery of the small intestine, nor previous to this observation have I been able to definitely demonstrate that an appendicular abscess was due to the perforation of a round intestinal worm. In the recent extensive literature on appendicitis I find that these two observations are unique. In the operative procedure (which will be discussed later in detail) necessary to completely drain the abscess and to prevent peritonitis, so much gauze was introduced into the abdominal cavity that one could feel quite certain that obstruction in some part of the lower portion of the ileum would follow. For this reason, twenty-seven hours after the first operation, without waiting for any sign of obstruction except distention. enterostomy was performed through the upper portion of the middleline wound. At this second operation it was definitely ascertained that obstruction had taken place. Although the enterostomy was performed as low as possible, so much small intestine was excluded that the patient rapidly developed symptoms of starvation, which, in spite of rectal feeding, were extreme by the sixteenth day. The obstructed portion of the ileum did not become patent until all the gauze had been removed from the abscess cavity and until the abscess had practically healed by granulation. This was demonstrated by the introduction of methylene blue about the twenty-eighth day. The patient, however, was then in a condition of such extreme weakness and emaciation that no extensive operation could be attempted to close the fecal fistula. Between the twenty-eighth and forty-second day the fecal fistula was patched up on two occasions. The temporary closure in each instance lasted four to five days. During this time the patient's general condition improved so much that on the forty-second day a more extensive operation with permanent lateral anastomosis was performed. is now eight weeks since this operation, and you see that the child is in perfect health. Eight weeks ago she weighed twenty pounds; to-day she weighs sixty-five.

The mental condition, due, without doubt, to starvation, was one of great interest. It was fully established by the sixteenth day. For a few days after the enterostomy the child continued to recognize her family and attendant and played with various toys. On about the tenth day she refused to pay any attention to her former almost constant companion, a new doll, and did not recognize anyone. She would not answer questions, and after the sixteenth day hardly ever articulated any sound except a low moan. She picked at the bed-clothes, and if she had not been restrained with a strait-jacket would have removed all dressings. Whenever she was fed or dressed she attempted to bite the nurse or surgeon. The appetite was ravenous. Only on the rarest occasions did she refuse nourishment. The fecal material which was discharged from the upper loop of the enterostomy was usually

well digested. Attempts at feeding through the lower loop failed. Rectal feeding was not well borne. The emaciation was extreme. Twenty pounds on the forty-second day. The child, as a rule, slept fairly well at night; during the day she was restless, with frequent moaning. There was never nausea or vomiting. The examination of the urine was negative. After the sixteenth day, when these symptoms were pretty well established, the patient's general strength remained about the same. To all appearances she had enough intestine to preserve life. This was the most encouraging sign and justified our delay in attempting to re-establish the continuity of the intestine until we were quite certain that the obstruction had been relieved. I was never able to definitely ascertain how much of the small intestine was excluded. I have never previously observed this extreme mental condition due to starvation, and it is interesting to note that this patient received enough nourishment from the upper portion of the small intestine to carry on the function of the lower centres of the brain only. The higher nerve centres were to all appearances inert. The recovery after the anastomosis from both the physical and mental condition of starvation was a very gradual one. Unfortunately, careful notes were not made. According to my recollection, she called me by name for the first time at about two weeks after the anastomosis. It was interesting to note that her memory of previous events should be so good; the probabilities are that she had not seen me a dozen times before she entered the comatose state. To-night you see a perfectly healthy child, without a sign of mental or physical disease and no indication of her illness except the healed abdominal wound. The child weighs, I should say, about ten pounds more than she did previous to her illness. older individual we would not expect such a rapid convalescence.

Note, July, 1903. It is now nine months since the operation, and I am informed by Drs. Hildebrand and Yost that the patient is in perfect health, and has exhibited no symptoms of postoperative neurosis or any sign of intestinal obstruction in spite of the extensive postoperative adhesions which must be present.

Clinical History in Detail.

M. K., white, aged eight years. Family and personal history negative. Always a healthy child. I was asked to see the patient in Glen Rock, Pa., by Drs. Hildebrand and Yost. The child had been sick thirty-six hours. There was no history of definite previous attacks, although the child had complained for a number of months, at irregular intervals, of abdominal colic, and had on a few occasions passed a round worm. The present attack was ushered in by severe abdominal pain referred to the umbilical area. This pain had increased somewhat in severity, but had not changed in character or location. Nausea and vomiting were absent; the bowels moved after the use of cathar-

tics. When first seen by her physician last night, twenty-four hours after the beginning of the illness, she was complaining of abdominal pain. On palpating the abdomen they found that all the muscles, chiefly the recti, were held slightly rigid. The child stated that the umbilical area was most tender. The pulse and respirations at that time were but slightly accelerated, and the temperature was 100° F.

I saw the patient on the morning of November 14th, thirty-six hours after the beginning of the illness. The mother told us that the child had passed a very restless night, sleeping but little on account of pain

in the abdomen.

Examination. Temperature 101° F., per rectum; pulse 110; respirations 24 to 30, chiefly thoracic. The girl has the appearance of a very healthy child; the muscles are firm; skin of good color; there is very little subcutaneous fat. The face has an anxious expression and the cheeks are slightly flushed, but there is not the drawn or pinched look of a child with peritonitis. The character of the pulse, although accelerated, is good. She complains of constant pain in the middle of the abdomen, and not in the epigastrium or in the right or left side. When the bowels moved during the night there was no pain, and voiding urine gave no discomfort. The abdomen looks but slightly distended; the distention is slightly more marked in the middle zone, beginning a little above the umbilicus and extending to within a few centimetres of the On palpation both recti muscles are held so rigid that it is impossible to make any depression. This muscle spasm is most marked from midway between the ensiform and umbilious down almost to the nubes. There is no muscle spasm in either lumbar fossa. Muscle spasm is slight in both iliac fossæ, perhaps slightly more marked in the right. On percussion the liver dulness is not obliterated, nor splenic dulness. The abdominal note is practically normal in the epigastrium and the flanks and left iliac fossa. In the umbilical and upper hypogastric regions extending slightly into the right iliac fossa the percussion note is not flat, but in view of the distention in this area is very much less tympanitic than if the distention was due to bowel. This area of impaired resonance combined with pain and intense muscle spasm associated with fever indicated an acute inflammatory process, probably abscess in the middle zone of the abdomen. There were no symptoms whatever of obstruction. For this reason I was inclined to feel that we should find an abscess, although an unusual position for an appendicular abscess.

Operation. Ether. As soon as the patient was completely narcotized the abdominal muscle spasm disappeared, and one could palpate in the middle zone of the abdomen a mass about the size of the two fists (10 x 10 cm.), slightly movable from right to left, but not from above down. For this reason the abdomen was opened in the middle line from a point a few centimetres above the umbilicus down to the pubes. On opening the peritoneal cavity there was no fluid, fibrin, or adhesions. The small intestines were slightly distended and perhaps the loops over the abscess were a little injected, but there was no peritonitis and no exudate. Beginning at the excum and extending at least to the third lumbar vertebra between the folds of the mesentery there was a mass. The exudate at the junction of the appendix and excum and ileum was sufficient to obliterate the appendix. Whether the appendix had an unusual position between the folds of the mesentery beneath the ileum

at the junction of the excum I could not tell, but at this point there was an exudate of fibrin obliterating anatomical marks. There was no exudate in the mesocolon behind the excum. On separating the exudate at the junction of the ileum and excum pus was encountered, and a large abscess cavity was found extending toward the vertebral

column between the folds of the mesentery.

I considered the possibility of making a lateral incision to the outer side of the cæcum and attempting to drain the abscess from this position, thus avoiding the danger of obstruction, but it could be easily demonstrated that it was impossible. The only way to properly drain this abscess and protect the peritoneal cavity was to use the middle-line incision, pushing the small intestines up and to the left and packing the gauze between the bladder on the lower side and the cæcum on the right. A great deal of packing was necessary to wall off the peritoneal cavity and to prevent leakage of the pus into the pelvic cavity. Although I attempted to use as little packing as possible, I felt quite certain that obstruction would be produced. For this reason I asked Dr. Hume, who assisted me, to remain with the patient and

bring her to Baltimore that afternoon or the next morning.

Note on admission to the Union Protestant Hospital, November 15th, 11 p.m., about twenty-four hours after the operation: Temperature 101.6° F., pulse 138, respiration 45. There is a symmetrical distention of the abdomen occupying the umbilical and epigastric area above the gauze drain; the distention is less in the flanks. The liver dulness is slightly obliterated; the child is restless; although the pulse is rapid it is of good character. Since the operation at Glen Rock there has been no nausea or vomiting, and the pulse, which was 178 after the operation, has varied between 130 and 140; the respirations from 24 to 32. The child complained of some abdominal pain, but slept at intervals during the night. From the clinical picture at this time one could not be certain that there was definite obstruction; distention of the degree present is frequently seen after laparotomy. I felt, however, that in view of the extensive gauze drainage the probabilities were that obstruction had been produced, and I did not consider it wise to delay for more definite symptoms.

Second operation for obstruction, twenty-seven hours after drainage of abscess, November 15th, 3 P.M. The closed incision above the gauze drainage in the middle line was opened; the packing apparently had remained in place undisturbed. It was surrounded on the upper and left side by coils of slightly adherent and considerably distended small intestine, and to the right side by the cæcum, which was not distended; to the lower side by the bladder. The transverse colon, which was exposed, was not distended. On separating the coils of small intestine from the gauze packing there was an exudate of fibrin and cloudy fluid, indicating at least beginning local peritonitis. The abdominal cavity about the gauze drainage was protected by new strips of gauze There had been and then the packing of the abscess was removed. some little leakage, and the cavity had contracted down to the diameter of the gauze introduced into the abscess cavity, about 5 x 3 cm. The cavity was lined, not by granulation tissue, but by a slightly hemorrhagic, necrotic exudate, and I found two or three round worms. This cavity was sponged out and again filled with bismuth gauze. A second incision was made to the right of the execum, and a piece of gauze was passed through the mesentery of the execum into the abscess cavity.

think now that this was an unnecessary procedure, but I felt at that time that drainage from this side might allow an earlier removal of the drainage into the cavity from the middle line; but one could only make a small opening through the mesentery of the cocum, as a larger opening would have jeopardized the blood supply. This completed the toilet for the drainage of the abscess. About the gauze which extended into the abscess cavity more gauze was placed in order to protect the general peritoneal cavity. I then selected a loop of small intestine as near as I could to the execum, but a loop that would not come in contact with the gauze drainage. I felt that if I selected a loop in contact with the gauze drainage it might become obstructed. This loop was brought out of the middle-line incision above the umbilicus and held in place by gauze packing between the loop and the parietal perito-Before suturing this loop in place it was opened and the distended gut emptied of its fluid and gaseous contents. accumulation of gas and fluid in the upper loops of the small intestine and the non-distended condition of the small intestine near the execum were pretty clear evidences of obstruction. I considered that if I did not empty the upper portions of the small intestine during the operation I could not expect with certainty that they would empty themselves. In addition, the immediate relief of the marked distention gave more room for proper drainage and partial closure of the wound. dition of the wound at the end of the operation was as follows: In the upper end of the incision the open loop of the intestine surrounded by gauze; the next 3 cm. the recti muscles were approximated with silver wire; below this the gauze packing protecting the general peritoneal cavity; then the gauze and rubber protective drainage into the abscess cavity.

Recovery from the Second Operation. The patient was considerably shocked. The temperature arose quickly to 103.6° F., pulse 160, respiration 28, leucocyte count 25,000. Six hours after operation a subcutaneous infusion of salt solution was given. Three hours later the patient was critically ill. Bacilli were found in the blood. The clinical picture was one of acute toxemia. At this time Dr. Hume gave the patient an intravenous infusion of 325 c.c. of silver nitrate solution. Within twelve hours her condition was very much better. In forty-eight hours the patient had completely recovered from the

shock.

During the remainder of the child's illness there were no complications to be dealt with except the eczema produced by the fecal dis-

charge and the condition of starvation.

The Treatment of the Fecal Fistula. From November 15th to December 15th the fecal fistula demanded almost hourly attention. For the first few days we were able to collect the fecal matter from the upper loop of the intestine through a rubber drainage-tube, but about this time it became almost impossible to keep the tube in place. Three or four round worms perforated the wall of the intestine about the tube and weakened the wall. The opening became larger and allowed leakage around the tube; any attempt at high introduction of the tube met with some obstruction. The leakage produced an extensive eczema of the skin of the abdomen. The patient did not stand the continuous bath treatment, which was tried for two or three days. A number of methods were attempted to protect the skin from the fecal discharge. Finally, Dr. Fisher succeeded in placing

a piece of rubber dam used by dentists about the intestinal opening in such a manner that the contents of the intestine passed through an opening in the rubber were collected there. In this way the skin was protected. Our usual method in fecal fistula is to keep a rubber drainage-tube in the upper loop to collect the discharge and every few hours to pass a catheter into the lower loop, and then introduce the contents collected from the upper portion of the intestine into the lower; that is, to feed the patient into the lower portion of the intestine with the partly digested contents of the upper. I used this method first in 1897 in a case of strangulated femoral hernia.

Unfortunately this method could not be used in this case. A permanent tube could not be introduced far enough into the upper loop of the intestine to prevent leakage, and the obstruction prevented feeding in the lower loop. This obstruction was not relieved until about December 13th, almost four weeks after the operation. At this time we were able to demonstrate that methylene blue introduced into the lower small intestine appeared in the discharge from the rectum, and also after feeding through the lower loop normal stools were ejected from the rectum. Having demonstrated that the obstruction was relieved, the condition of the patient demanded that the fecal fistula be closed

Closure of Fecal Fistula. On December 15th, the twenty-ninth day, without anæsthesia, the loop of the intestine in the upper portion of the wound which had been opened was partially separated, drawn partly out of the wound, and a rather rough lateral anastomosis made These were then closed. just below the divided ends. was difficult because the peritoneal surfaces were covered with granulation tissue. I felt that an attempt of this kind should be made first, because the general condition of the child contraindicated anæsthesia, and the condition of the skin, although it had improved very much since the use of the rubber dam, was still sufficiently bad, and it would have been difficult to prevent infection if the general peritoneal cavity had been opened. Fortunately, this suture held perfectly for three days. During this time the eczema practically disappeared and the child's strength increased; there was no question that the obstruction had been relieved, as there were normal stools. During the next four days the suture began to leak and demanded daily patching. For this reason on December 22d I felt that the condition of the child and the skin would allow an opening of the peritoneal cavity without great danger. was done to the left of the rectus, and two loops of intestine adherent to the wound which appeared to be the upper and lower loop were anastomosed by lateral suture. I did not think it was justifiable to separate all the adhesions and so make certain of the proper loops of the iutestine. Fearing, however, that the anastomosis might have been made between an upper or only a lower portion of the intestine, I patched up the original suture of the gut in the wound. Following this operation it was quickly demonstrated that the lateral suture had failed to restore the continuity of the alimentary canal. The patched-up suture in the wound was soon beyond further repair. Fortunately, however, these two temporary sutures in the wound had allowed the skin to completely recover from its eczema, and the restoration of the alimen-

¹ Operations on 459 Cases of Hernia, etc., Johns Hopkins Hospital Reports, vol. vii. vol. 126, No. 4.—october, 1903. 40

tary canal to its complete function gave the patient opportunity to gain in strength. The moment the temporary suture became irreparable, on December 27th, I decided to make the attempt at a permanent anastomosis of the two loops in the wound. The temporary suture had performed good service for almost eleven days. Fortunately, at this time, all the original gauze drainage into the abscess cavity and its surroundings had been removed, and the wound was practically closed up to the fecal fistula. At this last operation on December 27th the two portions of the intestine in the wound were separated and drawn out of the peritoneal cavity until there was at least 6 cm. of normal peritoneal surface. I was surprised at the few adhesions. extended hardly more than 1 cm. beyond the parietal peritoneum of the wound. There was little difficulty in separating and withdrawing these two loops of intestine and at the same time protecting the peritoneal cavity with gauze. That portion of these two loops forming the fecal fistula which was covered with granulation tissue was excised. This left practically normal intestine. A long lateral anastomosis was then made—at least 3½ cm.—beginning about 1½ cm. from the cut end. The ends were invaginated and closed. The anastomosed gut was allowed to drop back into the peritoneal cavity. It, however, was not pushed back. About 11 cm. projected beyond the skin. It was left in this position and surrounded with a few pieces of gauze. Only two sutures were placed in the lower portion of the wound. I considered that a lateral suture was much safer than an end-to-end, and that it was better not to make any attempt at complete closure of the wound. The result apparently has justified this procedure. The suture held. projecting anastomosed loops were rapidly withdrawn into the abdominal cavity and, after the removal of the ganze, became adherent to the recti muscles, and within three weeks the wound closed over with granulation tissue, and to-night, four weeks after operation, is completely covered with epidermis. The child has never exhibited symptoms of obstruction since the anastomosis.

In reporting the fortunate result of such a difficult and complicated surgical case it is only just to add that such results in surgery would be impossible except in a well-equipped hospital. In this instance especially I am convinced that the operative surgery would have been of little avail without the faithful and skilled attention of the trained nurse and the constant vigilance of the resident surgeon.

THE RESULTS IN BLOODLESS REPOSITION OF CONGENITAL DISLOCATION OF THE HIPS, WITH A REPORT OF CASES.

BY GWILYM G. DAVIS, M.D., of PHILADELPHIA.

THE cases reported were all subjected to forcible correction two to five years ago.

Case I.—Boy, aged three years; walked since the age of thirteen months. There was marked lordosis, limping, and a shortening of the affected (right) limb of one and a quarter inches (3.25 cm.). He

was placed in bed and extension of four pounds applied, with the limb in an abducted position, for eight weeks. He was then etherized (December 1, 1900), the adductor muscles cut, and the head of the femur replaced by flexion, abduction, and outward rotation, as advised by Paci. As reluxation occurred on attempting complete extension of the limb, it was bound in an abducted and externally rotated position on a straight posterior splint, which extended from beneath the back out along the posterior surface of the thigh to the knee, and he was confined to bed. The luxation recurring, the bone was again replaced and extension of four pounds, with the limb in the abducted position, was again applied. At the end of two months the leg was rotated strongly outward and the limb placed in plaster in marked abduction. At this time the head readily left its new position. Two months later the plaster was changed, the limb brought somewhat down, and a new plaster cast applied, with the limb markedly everted. The head now seemed fixed, and a few weeks later he was allowed to walk around. The plaster cast was afterward replaced with a metal brace, which held the foot in marked eversion.

On examining him now, two years and five months after reposition, we find about 2 cm. (four-fifths inch) shortening—a gain of 1.25 cm. The lordosis has almost entirely disappeared. The movement up and down in the hip is no longer present, and the head is now firmly fixed at the upper anterior edge of the acetabular region. It is what is termed an upward and anterior transposition. Instead of the head being loose on the dorsum of the ilium above and posterior to the acetabulum, it is now firmly fixed at its upper anterior edge. The functional result is good, as the movements of the hip are free and painless; he uses roller-skates, but there is still some limping, which is not at all marked. This is not an example of a perfect result, but it is a satisfactory result, as the only disability which remains is that due to shortening, which can be compensated by the high shoe. There

is twisting of the neck in this case.

Case II.—A girl, aged four years, born after a difficult parturition. Had been walking for a year and seven months previous to applying for treatment. Her peculiar waddling gait was noticed since she began walking. She was very unstable on her feet, falling readily. Lordosis was marked, the left trochanter being 3.5 cm. and the right 3.75 cm. (one and a half inches) above Nélaton's line. She was put to bed for six weeks, with first three and then five pounds' extension, with the limbs widely extended. She was then etherized, the adductor longus tendons cut, and both hips were readily reduced by the manipulations used in the previous case. A plaster cast was then applied, holding the limbs abducted not quite to a right angle, and rotated out so that the heels and toes were in the same transverse straight line. For convenience in handling and strength, a splint was fastened across the thighs from one to the other just above the knces. After two months a new cast was applied and the limbs brought partly down. As the right hip showed a tendency to slip out of position, a new cast was applied and continued below the knees. Seven months after reposition the right leg swelled and showed evidences of pressure (probably by the anteverted head pressing the femoral vein against the cast), so the cast was removed and reapplied. Two months later a plaster cast was applied to the hips and thighs and continued down

with jointed side irons to the shoes, where they were fastened, keeping the feet everted. She now began to walk a little sideways by holding onto the bed. One month later, ten months after reposition, she walked with crutches. All apparatus has been discontinued for more than a year.

On examining her, now two years and five months after operation, the left hip is found to be apparently normal in every respect. The right hip is found to be somewhat higher up and anterior than normal. On measuring it is found to be 2 cm. (four-fifths inch) shorter than the left. In other words, it is in a position of anterior and upward transposition. It seems firm and does not slide up and down when pressure is made on it. The lordosis is gone, but she still limps, which may partly be removed by the elevation of the sole of the shoe.

CASE III. was a girl, aged three years, with both hips dorsally luxated. The trochanters were very prominent and she walked with

difficulty, wabbling from side to side.

She was etherized, the adductors cut, and both hips replaced by manipulation. She was put up in plaster, the legs being abducted in the frog position, not quite at right angles to the body. In five weeks another cast was applied and left for another month. One hip was then found to be out. The cast was reapplied and a month later the hip was again found to be out. Operation was advised and refused. An extension brace was then applied and the child allowed to go around on crutches. After coming for awhile as an out-patient the case disappeared, the father being apparently desirous of escaping paying for the apparatus, and it was impossible to find him.

In this case one hip remained in place ever since its first replacement and never showed any tendency to come out again, even though the child had been walking on it for a couple of months. This case was lost sight of about six months after replacement. A fair result could have been obtained by brace treatment in the other hip also had

attendance been continued.

Case IV.—A girl, aged eight years, I showed to the Pediatric Society over three years ago. One hip was replaced five years ago by manipulation, the other by operation. A skiagram demonstrates a perfect anatomical result in the hip replaced by manipulation, and that the functional result in this hip is absolutely perfect now, five years later. The operated hip is firmly fixed in an anterior upward transposition.

To sum up, out of seven dislocated hips in four patients, one was operated on and one was lost sight of while under treatment. Of the other five, two were anterior transpositions and three were apparently perfectly normal in every way five years, two and a half years, and the last six months after replacement by manipulation.

Of the two anterior transpositions, one was a single dislocation in a boy, with a twisting of the neck of the femur; and while there is some shortening and limp remaining after two years and five months, the result is still satisfactory, because the head has become fixed and the centre of gravity has been thrown farther posteriorly. The former prevents any further increase of disability as age advances; on the contrary, the functional results will probably improve rather than

retrograde. The latter removes the tendency to lordosis, which later in life may prove very distressing.

The other transposition occurred in Case II., a double one, in which the other hip remained reduced in the acetabulum. This leg showed a shortening of about four-fifths of an inch, and the resulting limp is quite distinct. The fact, however, that one has been able to reduce one hip perfectly and fix the other one makes the result in this case also a satisfactory one, as the lordosis and tendency to increase have both been eliminated and the walking much improved. She plays and goes to school without getting tired. Previous to treatment the disability in this child was quite marked, as she was very unstable on her legs and frequently fell down. It is now two years and five months since reposition.

As regards the method of reduction, it is too intricate a subject to be discussed at this time; but I might state that these hips were practically all reduced by the method of circumduction as practised in traumatic luxations and as applied to congenital and pathological luxations by Paci, of Pisa, since 1888, with the addition of tenotomy of the adductor longus tendon.

There are two principal ways of replacing congenitally luxated hips. One is by an open operation in which the way for the head is cleared by the knife, and the other is forcible reposition, combined or not with extension and tenotomy. The latter has also been called the bloodless method in contradistinction to the open cutting operation.

Let us inquire into the results of the method by forcible reposition. In so doing it is essential that we bear in mind that different operators have different standards of what constitutes a cure. An exact reporter will of necessity have less so-called cures than an inexact one, and yet the results of the former may be better than those of the latter. The difference in the results of various cases is comparatively slight. They shade gradually from the bad into the good, and it is very difficult to draw a positive line of distinction. The age also has a marked influence on the results, and the older the patient the more difficult is it to achieve good results. There is likewise a considerable difference in the cases themselves, and this modifies the results. It is obvious that, with deformed femoral heads and necks and undeveloped acetabula, perfect results are an impossibility.

The difficulty of securing absolutely perfect results caused Paci to be extremely conservative as regards what was achieved. He only professed to put the head as near as possible in the acetabulum, and in his earlier writings, at least, he did not claim to put the head absolutely back into a normal position. It was only after he had been working six or seven years that, in 1894, he was able to obtain a specimen post-mortem which had been replaced by his method by A. Nota,

of Turin, four months previously. This showed both acetabula well formed, but one better than the other, thus conclusively demonstrating what had been doubted previously by Lovett, Lorenz, Kirmisson, and others. Thus we may accept as a demonstrated fact that within a period of four months from the time of reposition it is possible for at least a certain proportion of the replaced hips to have again resumed a practically normal condition. Kirmisson has always held that true repositions were very rare, and the conservative position of Paci has already been alluded to. When Lorenz, however, began practising the forcible reposition, he claimed that his results were absolutely curative and that the reposition was exact.

Kirmisson replied to this at the Paris International Congress in 1900, and showed that the skiagraph has demonstrated his former position to be correct; and Lorenz himself now speaks of "anatomical results," by which is meant that the head of the bone is shown apparently well seated in a socket, with a good overhanging edge to support it. Cases in which a displacement of the head can be shown are spoken of as transpositions. In these the head is usually fixed either anteriorly or anteriorly and upward. From this it is readily seen that when writers speak of a cure, one is not certain what is the actual condition obtained. Even when the result is a so-called cure by transposition, the functional results may be and usually are excellent. What some operators would call anatomical results (or cures) others might call transpositions.

When one considers the immediate results they may be either good or bad. If good, the head may be replaced at least approximately at the site of the original acetabulum with no serious effects from the manipulations employed. If bad, there may be a failure to replace the bone and serious injuries may be occasioned by the efforts at reduction. That the danger of serious injury being produced was appreciated by Paci is evidenced by his carefully cautioning against the use of undue force, for fear of fracturing the femur. The manner in which Lorenz applies forcible reduction is, however, mainly characterized by the exercise of great force; therefore, one is not surprised to find the resultant injuries both numerous and extensive. Paci in some of his cases used such mild manipulations as not to require an anæsthetic. Lorenz' states that in 450 cases he had three deaths from chloroform and shock alone; in addition there were eleven fractures of the neck of the femur, one of the pubic bone, one of the ilium, three paralyses of the peroneal nerve, seven of the anterior crural, besides some of the sciatic, and one total gangrene of the extremity. There were also instances of stiffness of the joint and the serious ruptures known as Narath herniæ.

¹ Heilung der angeborenen Hüftgelenks-Verrenkung, Wien, 1900.

Heusner, of Barmen, says that he and Hoffa have had even more serious results. Hoffa (German Congress, 1899) has had tearing of the soft parts (vulva and urethra), fractures and separation of the epiphyses, paralysis of the sciatic and anterior crural nerves, and suppuration of the hæmatomas which formed at the site of the rupture of the adductors. He even lost one child of six years.

Drs. Wilson and Dinkelspiel state that one of the patients operated on by Prof. Lorenz in this city during his recent visit was also seized with convulsions and went into a stupor, which, however, did not end fatally.

The dangers of circulatory disturbances occurring is shown by my Case II., in which some time after reposition the leg became swollen and blue and the cast had to be removed. This was due to the head, as it came forward, pressing the femoral vein against the inside of the cast. The Narath herniæ alluded to were described by Narath,² of Utrecht, who said they had occurred in 12 per cent. of his cases. They were large herniæ which came down beneath Poupart's ligament, and were supposed to be due to tearing of the fascia lata and other tissues in front of the head of the femur. Lorenz, both by his writings and demonstrations, has advocated the exercise of such extreme force in attempting reductions that his followers will probably repeat some of his bad as well as his good results.

When we come to consider the ultimate results we find that we must allow some time to elapse before assuming them to be definite. When a congenitally displaced hip has been replaced it is not as if the case was one of traumatic luxation. In the latter a normal head goes back to a normal acetabulum and stays there; in the congenital a more or less altered head goes back to a more or less altered acetabulum and often does not stay there. In Case IV., one of congenital double luxation, on one side the hip remained in place, but the other persistently luxated and was, therefore, operated on by open incision. One hip in Case III. persistently reluxated and was put under treatment by apparatus. One hip of Case II. also came out, but was eventually fixed in an anterior transposition. In Case I., of single luxation, the head was only fixed by repeated reluxations.

This tendency to reluxation seems to exist in approximately one-half the cases. In my own experience the cases that have remained reduced have done well from the start, and have shown but little tendency to reluxation at any time after replacement. The exact position of the head of the femur cannot be determined while the fixation bandage is on. Therefore, it is at the time of the first removal of the plaster

¹ Zeitschrift für orthopædische Chirurgie, 1902.

² Report of German Surgical Congress, 1899.

bandage that one is able to determine whether or not reduction has been maintained. If it has not, reposition must again be performed. Iu most of the cases which show a more or less marked tendency to reluxation a good result can be obtained by means of prolonged treatment. They usually constitute the cases known as transpositions, in which the head of the femur, instead of being placed exactly in the acetabulum, is more toward its upper edge or upper anterior edge, near the anterior inferior spine of the ilium. These patients can usually walk fairly well without marked fatigue. The limb is usually shorter than normal, but its range of movement is good. Some limping usually persists in spite of a high shoe, and if the case is a double one. with one hip replaced and the other transposed, the limping may be marked. The lordosis is in most cases nearly or quite abolished. is evident that good results cannot be expected if the bones are abnormal. The neck or shaft of the femur may be twisted so that when the foot points forward the head is in a position of anterior transposition. Some of these cases can be remedied by doing a subtrochanteric osteotomy and turning the foot more outward.

In other cases instead of the head and neck forming an angle of 130 degrees or more with the shaft it may form a right angle or less. This causes a condition known as coxa vara, and the thigh is more or less fixed in an adducted position. Abduction in these cases is much restricted. Shortening is also present. When there is a deformity or partial lack of the cotyloid cavity and head of the femur, complete failure might occur, or considerable shortening with a more or less marked coxa vara condition, even if one was successful in fixing the head.

Let us now look at some of the statistics which have been brought forward as illustrating the results of the method of forcible reposition:

Lorenz, in his book published in 1900, gives, out of 212 cases, 108 anatomical cures in which the skiagraph showed the head under a good, overhanging, acetabular edge. Of these 108, 61 were one-sided luxations occurring in 102 cases, and 47 were in children with double luxations and occurred in 110 joints in 55 children. Subluxation occurred in 20 cases and forward and upward luxation in 82 cases.

Hoffa, out of 64 cases, 42 single and 22 double, reduced all; they varied from two to eight years in age. Great injuries were done to the soft parts, etc. Of the 42 single repositions, 4 remained cured and 1 of these was found to have a condition of coxa vara. In 1 case complete reluxation followed; in 25 the head was transposed in frout and up, and in 11 more anterior, near the anterior inferior spine. Of the 22 double luxations, in 3 both sides reluxated; in 4 there was

reposition on one side and transposition on the other; and in the remaining 15 there was transposition in the hips of both sides.

Max Schede's clinic, as given by Petersen, in 113 cases, 61 single and 52 double, there were 6 cures; in 48 the head was near the correct position in the acetabulum, and in 59 it was transposed anteriorly.

Mikulicz's clinic, as given by Drehmann,² in 131 cases there was failure to replace in 7, 1 of which was over ten years of age and the other 6 from four to ten years. In 118 repositions, operation was later done in 6 for reluxations; in 4 cases the results were not known, and 2 cases died, leaving 106—82 single, 42 double; 87 of these have been under treatment one-half year or more—66 single, 21 double. Of the 66 single, in 48 reposition remained and iu 18 was transposed.

Of the 21 double cases, with 42 hips, 6 failed, 14 were transposed, and 22 remained in position.

Heusner (German Congress, 1899) considered in 10 per cent. the results excellent, in 30 to 50 per cent. good after long treatment, and in the remainder unpromising.

Karl Ludloff, in 11 cases, claims satisfactory results in 9; 2 were nearly ideal, 4 were good, 3 showed coxa vara; in 1 was a partial reluxation, and iu 1 there was a double coxa vara with marked restriction of motion.

Among others, Kollicker, in 25 single and 13 double cases, claimed only two cures; Codivilla, in 66 cases, four to five, and Kümmel about 5 per cent., stating that unfortuate occurrences are not rare.

The experiences of American surgeons—Bradford, Whitman, Sherman, Ridlon, and others—have been much like those already related.

In considering the various facts here presented, one may fairly conclude that Kirmisson had good grounds for stating that perfect reposition was rarely attained. They also furnish evidence of the good judgment of Paci in refraining from claiming for his method an absolute cure. If one is critical, as is apparently the case with Kirmisson, Hoffa, Kollicker, Schede, Codivilla, and others, then one will call 5 per cent. cured. If one is more easily satisfied, then the cures will amount to 50 per cent., as in the case of Lorenz, or more, as in the case of Mikulicz. The truth probably is that the results in the hands of the various operators do not differ so much as do their statistics. It appears to be the fact that total failures below the age of six to eight years are comparatively rare; that approximately one-half the cases are replaced in a more or less normal acetabulum and are kept there; that a small proportion of these are apparently quite normal; that in most of the remainder the head is transposed forward or forward and upward and

¹ Deutsche Zeitschrift für Chirurgie, Bd. l., S. 531.

² Zeitsehrift für Orthopædische Chirurgie, 1903, p. 304.

remains in this position. In many of these cases of partial repositions the condition can be subsequently improved, as pointed out by Whitman, Max Schede, Bradford, Kirmisson, and others, by subsequent operations, as osteotomy. A certain number of cases seem to do well from the moment of reposition and remain in place without trouble; perhaps half show more or less of a tendency either to slip backward into their previous luxated position or anterior. These are to be treated by subsequent reposition and reapplication of the bandages and the use of various forms of apparatus. To speak of a cure soon after reposition has been performed is ridiculous. Lorenz stated that he did not bring the legs parallel to each other for two years after reposition. exact power possessed by the human economy to form a new joint is as yet a matter of doubt. The pathological preparatious obtained of joints which had been replaced some time before death, as those of Paci, Bradford, Ochsner, and others, show that good joints do form, but they may have been nearly normal at the time of reposition. fact that deformities of the head, neck, and acetabulum may exist should cause one to be guarded in promising as to the results to be achieved by treatment in any given case.

TORTUOSITY OF THE AORTA.

BY JOSEPH SAILER, M.D.,

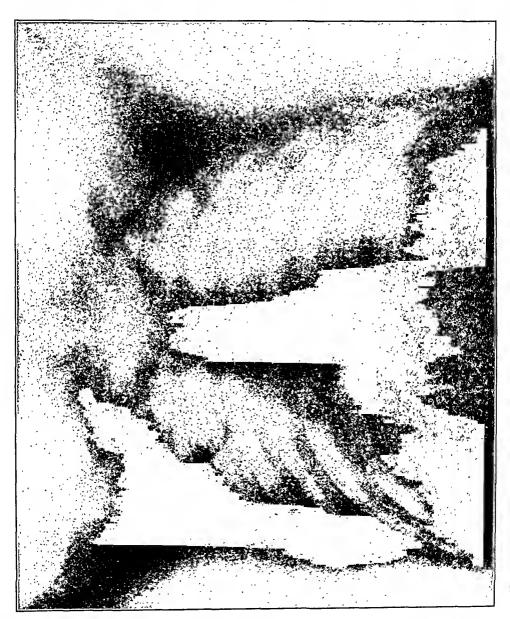
AND

G. E. PFAHLER, M.D., OF PHILADELPHIA.

In the course of a series of studies upon lesions of the aorta, which consisted of careful clinical examinations combined with fluoroscopic and radiographic examinatious, we were surprised at the frequency with which some of the lesser signs of aortic aueurism were present. Among these were inequality of the radial pulses, suprasternal pulsation, tracheal tugging, accentuation of the aortic second sound, and brassy cough. Not infrequently the patients complained of certain other symptoms, particularly dyspnæa, anginoid attacks, and localized pains. In many cases aneurism was undoubtedly present, either causing characteristic pressure symptoms or being manifest as an external expansile pulsation. In a number of cases, however, we observed with the fluoroscope an expansion in the shadow of the aorta at the level of the fifth or sixth dorsal vertebra, extending from one-half to two inches to the left. This, we supposed, represented an aneurismal dilatation of the aorta at this point. Upon all cases that died effort was made to obtain autop-

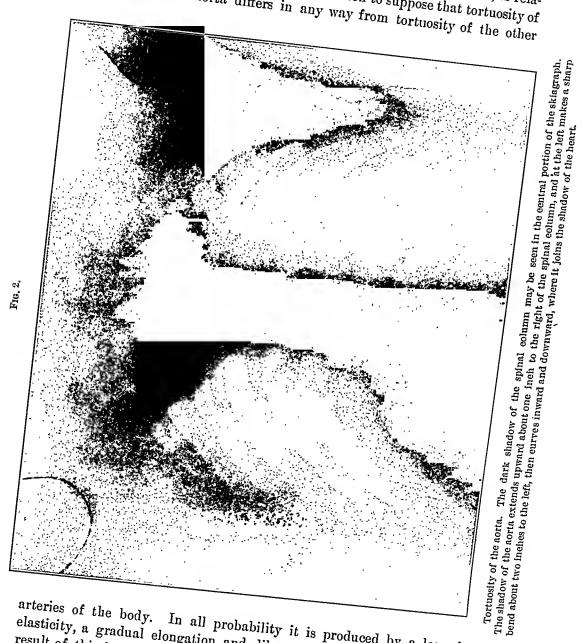
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sies, sometimes successfully; and we discovered that in the majority of cases in which this skiagraphic picture was observed no dilatation of the aorta was present, nor did sections through the wall of the aorta at this point indicate that there was any diminution of the muscular layer, such as might have accounted for dilatation under pressure of the blood



current. In the second autopsy careful dissection showed that at this point the aorta made a bend to the left, not very unlike the tortuosity that is observed frequently in cases of atheroma of the peripheral arteries. Altogether we have records of eighteen cases with skiagraphs in which this combination occurred, and of these four have been exam-

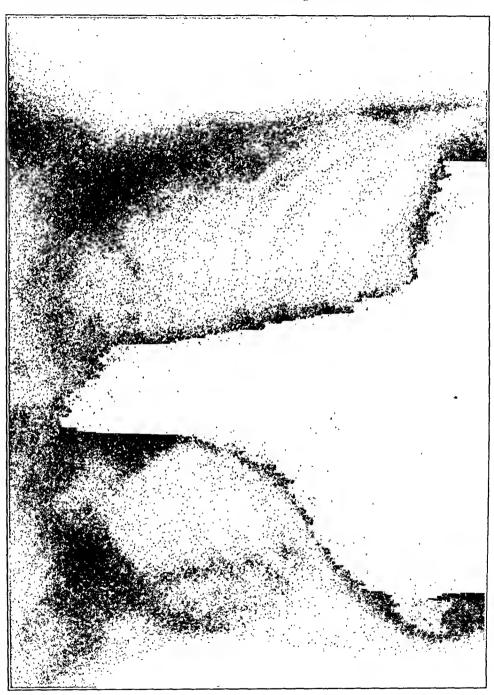
ined post-mortem, all with similar results. It seems not unlikely, therefore, that among subjects of arterial sclerosis this tortuosity of the aorta, giving rise to some of the signs of aneurism of the arch, is relatively a common process. There is no reason to suppose that tortuosity of the arch of the aorta differs in any way from tortuosity of the other



arteries of the body. In all probability it is produced by a loss of elasticity, a gradual elongation and dilatation of the bloodvessel as a result of this loss, and the fact that at certain points in its course the artery is fixed, so that between these points compensation for elongation is only accomplished by bending. It would seem as if in the aorta

a the last nortion of the arch

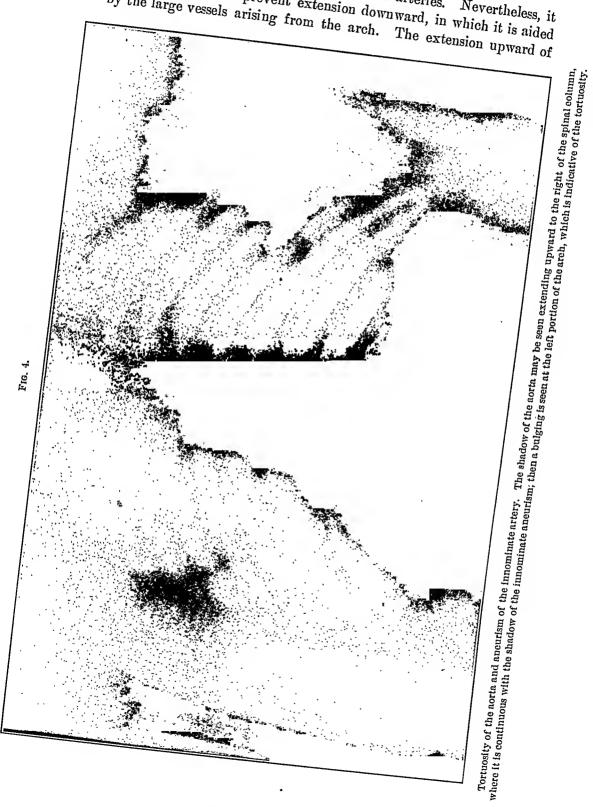
this compensation could be attained by increase in the height of the The arch of the aorta is practically fixed at two points: the arch. aortic orifice of the left ventricle, and the point where it reaches the



vertebral column at the level of the fifth dorsal vertebra. The position of the attachment to the heart can only vary when the heart itself is moved; the attachment to the vertebra is not quite so firm and is made

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by connective tissue and by the intercostal arteries. is sufficiently firm to prevent extension downward, in which it is aided by the large vessels arising from the arch. The extension upward of

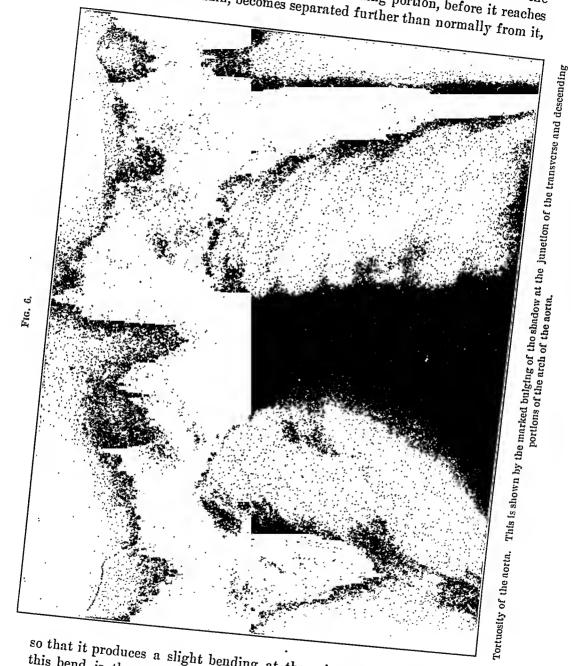


the arch is hindered by the closeness of the manubrium to the bodies of the vertebra and the fact that the space between them contains the trachea, the œsophagus, and the vessels arising from the arch. That a certain amount of extension upward usually does occur is evidenced by



the frequency of suprasternal pulsation, but this extension can only be moderate, and the elongation of the aorta, exposed as it is to the full force of the contraction of the left ventricle, in all probability must be frequently so great that it cannot be compensated entirely by this

movement; therefore it is obliged to deviate laterally, in which direction it meets little to resist it except the compressible upper lobe of the left lung. As a result of this, the descending portion, before it reaches the vertebral column, becomes separated further than normally from it,



so that it produces a slight bending at the point where they join, and this bend is the tortuosity that we have observed in our skiagrams. The examinations of the aorta in old persons have convinced us that this tortuosity is by no means uncommon, even in patients who have

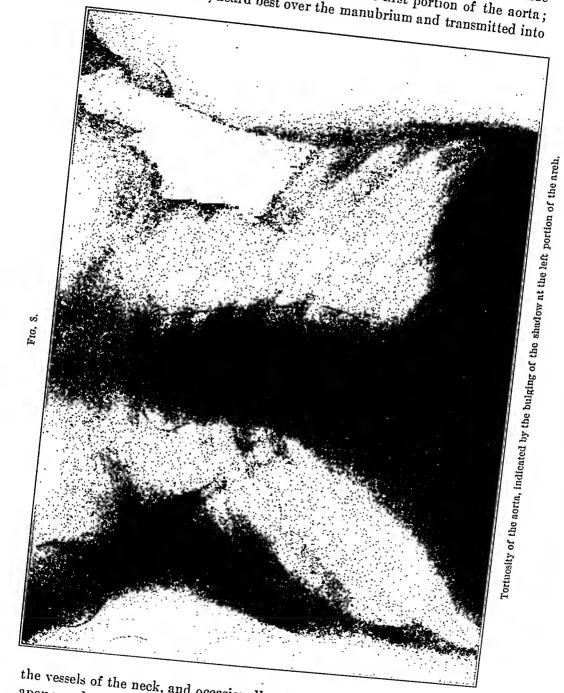
not necessarily had clinical symptoms that attracted attention. If at an autopsy or a dissection, after the removal of the sternum, the left lung is carefully dissected away without disturbing the position of the



heart, aorta, or right lung, the whole arch of the aorta is then exposed and any irregularity readily demonstrated.

Atheroma of the aorta has received considerable attention from clinicians. The physical signs that it is supposed to cause, however, have been, as a rule, limited to an impairment of the resonant note over the

upper portion of the sternum, which may extend slightly to either side of its border, and is due to dilatation of the first portion of the aorta; a systolic murmur, heard best over the manubrium and transmitted into



the vessels of the neck, and occasionally-it is stated-heard also at the apex; and sometimes a double murmur, due less to the atheromatous condition than to the insufficiency of the aortic valves, which is secondary

Sansom¹ mentions the fact that sometimes the areh of the aorta is elevated, eausing elevation of the left subclavian and the innominate, and rendering these arteries more susceptible to palpation, so that it is easy to produce a thrill in them on pressure; and occasionally the The symptoms of atheroma are pain, thrill occurs spontaneously. dyspnœa, and sometimes anginoid attacks. We have been unable to find any reference to inequality of the pulses, tracheal tugging, inequality of the pupils, and suprasternal pulsation. There is some difference of opinion as to whether the second aortic sound is invariably accentuated or not. It does not appear to have been recorded that typical aneurismal cough may occur as a result of an atheromatous condition without aneurismal dilatation.

The investigators, who employed the fluoroscope or skiagrams for the purpose of studying changes in the aorta, were early impressed by the fact that although aneurism was oceasionally overlooked, it was more frequently diagnosed when it did not exist. In 1897 Levy-Dorne² stated that the early stages of aneurism were more common than had hitherto been supposed, and that the prognosis of commencing aneurism appeared to be not so unfavorable, especially as only a few had any tendency to His pictures illustrate the small pulsating projections to the left of the sternum. Gocht, a year later, thought that by means of the Röntgen ray it was possible for the clinician to determine the presence of aneurism in cases in which doubtful symptoms were present. In opposition to this, Dumstrey and Metzner recommend considerable caution in the diagnosis of aneurism by means of the Röntgen rays, especially when there are no physical symptoms. They thought that mediastinal tumors might give rise to the same picture. Holzknecht⁵ was the first to show that pulsating hemispherical shadows just above the heart are not always aneurisms. He argued that this idea was based upon the supposition that the thoracie aorta was always situated in the median line, and that the arch lies in the shadow of the sternum. This is true only of the ascending portion of the arch, and as the transverse and descending portions lie practically in the same plane, they are projected as a pulsating, band-like shadow, intensely dark and with a free end. It may be seen during life, although he agrees with Weinberger that it rarely projects considerably to the left. This projection has also been observed and described by Immelmann. Holzkneeht later discussed the subject more thoroughly in his text-In this he stated that aneurism of the arch theoretically was usually seen to the right of the sternum in sagittal pietures. Dilatation gives rise to a shadow seen on either side of the sternum, and is readily confused with aneurism. The differential diagnosis can be made by the fact that there are no pressure symptoms and no tendency of the shadow to enlarge. Simple dislocation of the aorta usually appears

just to the left of the spinal column, and the pulsating shadow sometimes extends as much as six inches to the left of the left border of the sternum, forming, in fact, a pulsating shadow much larger than that projected by aneurism of the arch. In cases in which the heart is elevated the natural bending of the heart to the left is increased. In forty-six cases that he observed in which this shadow was present only six proved ultimately to be cases of anenrism. Holzknecht has undoubtedly seen and correctly interpreted the picture to which we call attention; but he classifies all these conditions as dislocation of the aorta, and fails to recognize that there is usually an actual elongation of the vessel, and that, in addition to the thrusting of the arch to one side, there is also a condition of tortuosity.

The following are the abridged notes of the cases that we observed:

CASE I.—P. H., aged thirty-eight years, a negro hostler. Had syphilis at the age of fifteen years. Eighteen months before death he received a blow over the right clavicle, and later noticed pulsation in the right side of the neck, followed by pain, cough, and paroxysms of dyspuca.

side of the neck, followed by pain, cough, and paroxysms of dyspuca. Physical Examination. The pupils were equal. The right radial pulse was absent; the left radial pulse was small. The right carotid pulse was absent, and the left carotid pulse and its branches pulsated vigorously. There was pulsation of the prominent sternal end of the right clavicle, due to a mass beneath in which there was neither thrill nor murmur. The right external jugular vein was distended. The area of cardiac dulness was normal. The aortic second sound was accentuated. A diagnosis of innominate aneurism was made, but it was difficult to explain why the left radial pulse was so weak. The fluoroscope showed a pulsating tumor in the region of the innominate, and a prominence to the left of the descending aorta that had expansile pulsation. At the autopsy there was found aneurism of the innominate artery and atheroma and tortuosity of the arch of the aorta. Case II.—W. B., white, aged sixty-nine years, a printer. Had been

Case II.—W. B., white, aged sixty-nine years, a printer. Had been an inmate of an insane asylum. There was no history of rheumatism; he denied syphilis; he had smallpox at thirty-nine years. He complained of dyspnæa on exertion, pain, and cough. He also was

maniacal.

Physical Examination. The left subclavian artery and its branches pulsated more weakly than the corresponding arteries to the right. The carotids were equal. There was distinct downward tracheal tugging and suprasternal pulsation. The left ventricle was dilated, and there was a systolic murmur transmitted into the vessels of the neck. The fluoroscope showed a prominence to the left of the aorta, which had expansile pulsation. At the autopsy there was atheroma of the aorta with tortuosity of the descending portion. There was no aneurism and no dilatation.

CASE III.—J. H., white, aged fifty-seven years, machinist. He denied rheumatism and syphilis, but had had heart trouble for ten years. He complained of pain in the precordial region and dyspnæa.

Physical Examination. There was a receding pulse, with Traube's and Durosiez's signs. There was suprasternal pulsation and doubtful tracheal tugging. The left ventricle was considerably enlarged. There

was the double murmur of aortic regurgitation. There was no accentuation of the aortic second sound. The X-ray showed the characteristic pulsating prominence to the left of the aorta. A diagnosis was made of insufficiency of the aortic valves, dilatation of the aorta, and tortuosity.

Case IV.—J. L., white, aged ninety-seven years, shoemaker. denied syphilis and rheumatism. He suffered from dyspnæa on exer-

tion; he had no cough and no pain.

Physical Examination. The arteries of the distribution of the left subclavian pulsated more freely than those of the right. The carotids were equal. There was suprasternal pulsation and slight tracheal tug-The percussion note over the base of the sternum was impaired. There was general atheroma. The fluoroscope showed a pulsating mass to the right of the descending arch of the aorta. At the autopsy the aorta was found to be tortuous, and there was no aneurism and no dilatation.

CASE V.-N. McC., white, aged seventy-three years, stone-mason. Had had rheumatism and used alcohol to excess. He complained of dyspnæa on exertion and had a cough that was slightly metallic.

Physical Examination. The carotid and radial pulses were equal. There was distinct suprasternal pulsation and tracheal tugging. There was impaired resonance over the manubrium, and the second aortic sound was accentuated. The fluoroscope showed an abnormally broad aortic arch and pulsating prominence to the left of the descending arch.

CASE VI.-W. S., white, aged twenty-four years, a barber. He gave a history of rheumatism, and admitted alcohol in moderation, but denied syphilis. He had no dyspnæa and no pain. He had a hoarse but not metallic cough. The radial and carotid pulses were equal; there was distinct tracheal tugging; there was impaired resonance over the manubrium, and a faint systolic murmur heard over the base and transmitted into the vessels of the neck. There was no thrill. The fluoroscope showed a pulsating prominence to the left of the descending portion of the arch of the aorta.

CASE VII.—A. T., a laborer, had had rheumatism. He admitted alcohol in moderation, but denied syphilis. There was dyspnœa upon

exertion and precordial pain, but no cough.

Physical Examination. The left radial pulse was smaller than the There was no tracheal tugging and no suprasternal pulsation. The fluoroscope showed a pulsating projection to the left of the descending portion of the arch of the aorta.

CASE VIII.—J. W., aged forty-three years, a negro laborer. Many of his family had heart disease. He had acute articular rheumatism at twenty-five years. On admission he had dyspnœa increased by exertion, cough and expectoration, and pain in the chest and epigastrium.

Physical Examination. The left radial was smaller than the right and scemed slightly retarded. The arteries were atheromatous. heart was enlarged; there was a systolic musical murmur transmitted into the vessels of the neck, which subsequently showed a double murmur. There was slight tracheal tugging; a thrill was readily produced by pressure upon the subclavians and occasionally was spontaneous. The fluoroscope confirmed the great enlargement of the heart, the increased breadth of the arch of the aorta, and also showed a projection to the left of the descending portion of the arch that had expansile pulsation. At the autopsy obliterative pericarditis was found, with hypertrophy of the heart, atheroma and marked dilatation, and tortuosity of the aorta at the junction of the arch and the vertebral column.

CASE IX.—H. W., white, aged sixty-eight years, a carpenter. He suffered from dyspnæa on exertion and gave a doubtful history of

paralytic stroke.

Physical Examination. The left radial pulse was smaller than the right. The carotids were equal; the left pupil was slightly dilated. The heart was enlarged; there was a double murmur over the base; suprasternal pulsation and distinct tracheal tugging. Percussion resonance over the manubrium was impaired. The fluoroscope showed a pulsating projection to the left of the descending portion of the arch.

CASE X.—W. S., white, aged seventy years, a laborer. Had had rheumatism, but denied syphilis. He complained of severe cough,

which was distinctly metallic in character.

Physical Examination. The left radial pulse was smaller than the right. There was distinct tracheal tugging; impaired resonance over the manubrium. The fluoroscope showed a distinct bulging to the left of the descending portion of the arch of the aorta which had expansile pulsation.

CASE XI.—S. McH., white, aged fifty-one years, a carpenter. Admitted syphilitic infection. At forty-three years had right hemi-

plegia.

Physical Examination. The pupils were equal; the carotids and radial pulses were equal. There was tracheal tugging and a faint suprasternal pulsation. The heart was not enlarged. The second aortic sound was not accentuated, but the first sound was loud. There was impaired resonance over the manubrium, and the patient had a hoarse, aneurismal cough, which had lasted seven years. The fluoroscope showed increased width of the arch of the aorta, and a projection to the left of the descending portion of the arch which had expansile pulsation.

Case XII.—M. O., white, female, a domestic. She had been con-

scious of heart disease for two years

Physical Examination. Pupils were equal; the right radial pulse was slightly weaker than the left. There was expansile pulsation in the lower portion of the neck, which was apparently due to an atheromatous anomalous vessel. There was no tracheal tugging and no thrill. The heart was enlarged to the right and left. There was a systolic murmur transmitted into the vessels of the neck. The aortic second sound was greatly accentuated, and the pulmonic second was reduplicated. The percussion note over the manubrium was impaired. The patient had dyspnæa, but no pain and no cough. The fluoroscope showed dilatation of the ascending portion of the arch of the aorta that had expansile pulsation.

CASE XIII.—T. M., white, aged thirty-six years, laborer. He had had malaria, rheumatism, and syphilis, and admitted excessive indulgence in alcohol. For about two years he had had boring pain in the left chest, located usually in the sixth interspace, either just beneath the angle of the scapula or in the nipple line. It was worse after exertion

and the sixth rib was tender.

Physical Examination. Pulsation in the left subclavian, brachial, and radial arteries could not be felt. In the right subclavian, brachial,

and radial arteries it was strong. The carotids were equal. There was a systolic murmur, heard best at the apex. The aortic second sound was greatly accentuated. There was slight paralysis of the left vocal cord (Dr. Gleason). The fluoroscope showed a distinct prominence of the descending portion of the arch, which had expansile pulsation. There was no dilatation of the aorta in any part. The patient is still alive, and the signs have not changed in eighteen months. It seems not impossible that in this case we are dealing with an actual aneurism, although the fluoroscopic picture is the same as that in the other cases.

CASE XIV.—R. W., white, aged forty-four years, a knife-grinder. He had had psoriasis for twenty years, and had used alcohol and tobacco to excess. He denied venereal disease. One year ago he had erysipclas.

Physical Examination. The pupils were equal; the left brachial and radial arteries pulsated more weakly than the right. The carotid pulses were equal. The heart was not enlarged. The aortic second sound was accentuated; there was no suprasternal pulsation, but distinct tracheal tugging. The fluoroscope showed increase in the width of the arch of the aorta, and a projection to the left of the descending portion which had expansile pulsation.

CASE XV.—M. B., white, female, domestic, aged seventy years. Had had rheumatism for many years. Had dyspnæa upon exertion, and had complained for twenty years of pain in the left side of the chest. There was a cough, which was not metallic in character.

Physical Examination. The radial pulses were equal; there was an anomalous vessel crossing the anterior portion of the neck, which was atheromatous. There was no tracheal tugging. The heart was slightly enlarged, and there was a double murmur over the base, the systolic element being transmitted into the vessels of the neck. The fluoroscope showed dilatation of the ascending portion and a projection to the left of the descending portion of the arch of the aorta which had expansile pulsation.

CASE XVI.—J. T., white, aged sixty-one years, broom-maker. Had malaria at sixty-six years; pleurisy at forty-five years; several attacks of asthma. He denied syphilis. He complained of cough and moderate

expectoration.

Physical Examination. The right carotid and subclavian arteries and their branches pulsated more vigorously than the corresponding vessels on the left. There was no tracheal tugging, but a powerful suprasternal pulsation. The heart was slightly enlarged. There was a systolic murmur transmitted into the vessels of the neck, and the aortic second sound was accentuated. The fluoroscope showed dilatation of the ascending portion of the arch of the aorta and distinct prominence of the descending portion of the arch, with expansile pulsation.

CASE XVII.—P. D., white, stone-cutter. Had used alcohol to excess; he never had rheumatism, and denied syphilis. There was moderate dyspnæa, pain in the region of the heart, and a cough which

was not metallic in character.

Physical Examination. The pupils were equal and of the Argyll-Robertson type. The right pupil was smaller than the left. The carotid and radial pulses were equal. There was a thrill in the vessels of the neck upon pressure. There was suprasternal pulsation and distinct tracheal tugging. The heart was slightly enlarged to the left;

there was a soft systolic murmur at the apex and base, and a harsh systolic murmur at the base. There was also a harsh systolic murmur in the vessels of the neck. The aortic second sound was not accentuated. The fluoroscope showed dilatation of the ascending portion of the arch of the aorta, and a projection to the left of the descending portion which had expansile pulsation.

CASE XVIII.—C. H., white, female, domestic, aged eighteen years. Patient had recently had acute articular rheumatism.

Physical Examination. The carotids and radials were equal. There was suprasternal pulsation, but no tracheal tugging. The heart was not enlarged; the second aortic sound was greatly accentuated. fluoroscope showed that the ascending portion of the arch was increased three-fourths of an inch in width, and to the left of the descending portiou there was a shadow that had expansile pulsation.

In summarizing these cases we find that the inequality of the pulses was present in ten and not present in eight cases; that in nine of the ten cases pulsation was more vigorous on the right than on the left Inequality of the pupils was present in three cases; in one of these there was reason to believe that it was due to some nervous condition, as the pupils showed the Argyll-Robertson phenomenon. Suprasternal pulsation was present in twelve cases and absent in six. Tracheal tugging of distinct downward character was present in eleven and absent in seven cases. A systolic thrill was felt in the vessels of the neck, either with or without slight pressure, in nine cases, and it could not be elicited in nine cases. A systolic murmur usually transmitted into the vessels of the neck was present in eleven cases, but was not heard in seven cases. Twelve of the cases had dyspnœa; in one of these there were physical signs of emphysema and chronic bronchitis; in the others it was probably due to the cardiac condition. Many of these patients were old, and nearly all of them had atheromatous arteries. Precordial pain was present in seven cases and was not complained of in eleven cases. In many of the cases complications in the form of valvular heart disease were present. In one case there was actually an aneurism of the innominate artery. The degree of atheroma and the age of the patient also modified the symptoms, and the extent of the tortuosity must vary considerably in different cases.

It is difficult from this study to give a clear picture of the symptomatology of the condition of atheroma of the aorta leading to tortuosity of the descending portion of the arch. It may at least be said that in those conditions in which atheroma and tortuosity exist, certain of the physical signs, particularly tracheal tug and inequality of the radial pulses, which have been supposed to be strongly suggestive of aneurism, are not uncommon, and that they are associated with other signs and symptoms, such as murmur, thrill, suprasternal pulsation, inequality of the pupils, accentuation of the aortic second sound, that are also found in aneurism of the arch. Probably it would be justifiable to suspect tortuosity in cases in which there is inequality of the radial pulses, slight tracheal tugging, dyspnœa, and in which the symptoms are stationary for a considerable period of time and the fluoroscope shows a projection to the left of the descending portion of the arch of the aorta that has expansile pulsation.

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THE OCCURRENCE OF THE BENCE-JONES ALBUMIN IN A PLEURITIC EFFUSION.

BY ISADOR H. CORIAT, M.D., WORCESTER INSANE HOSPITAL.

THE peculiar albumose-like body which has been named after Bence-Jones, who first gave it serious research, has during recent years demanded much attention. It is found in the urine of patients suffering from malignant bone disease, in particular either multiple myeloma or sarcomatosis, and also in the blood and bone-marrow of these condi-Formerly it was thought to occur in osteomalacia, but it is now recognized by more modern methods of examination that what had been previously designated as osteomalacia is in reality multiple myeloma. The uniting of these facts has made the urinary examination of the highest importance in the diagnosis of obscure bone disease, especially those in which there is an absence of metastasis and several bones become simultaneously the seat of the new-growth. An albumose resembling the Bence-Jones body has been described by R. Fleischer' as occurring in normal bone-marrow, but further research along this line by the more modern methods of the separation of various albumoses seems to be necessary. The substance has also been encountered in the urine of animals the subjects of experimental pyrodin anemia. To these findings I am now able to add to the reported series a case in which the Bence-Jones albumin could be demonstrated in large quantities in the pleuritic effusion of a patient suffering from multiple neuritis associated with extreme tenderness of the ribs, while it was absent from the urine. So far as I am able to discover this is a new observation, and one which I hope will cast some light on the muchdiscussed question of the origin of this substance. Although the

pleuritic effusion was very slightly purulent, yet in the literature there can be found only the vaguest references to the occurrence of "albumose" and "peptone" in pus and pathological pleuritic fluids. My case is the first to occur in the wards of an insane hospital, and the patient was the subject of an extensive multiple neuritis associated with a peculiar mental condition, of which the prominent symptoms were a profound memory defect associated with extensive fabrications. The clinical history is given in detail in order that the reader may judge of the varied symptom-complex under which this body may be demonstrated.

Polyneuritic delirium (Kersakow's disease); alcoholic excesses; multiple neuritis; extreme tenderness of the ribs; pleurisy with effusion; albumose in the pleuritic fluid; urine negative; no anæmia. The patient was an Englishmau, aged forty-two years, of whose personal history but little is known, except that for several years he drank heavily and was frequently intoxicated. He was admitted to the Worcester Insane Hospital on October 29, 1902, with a certificate stating that the onset of his trouble had been several weeks previously, that he was in poor bodily health, and in a state of complete mental confusion. On admission to the hospital he was immediately placed in bed on account of his weak condition, as he was scarcely able to stand. There was a profound delirium with disorientation, prominent memory defect for both recent and remote impressions, and extensive fabrications which he constantly utilized to fill up the gaps in his memory. The mental condition has remained unchauged since admission. He was occasionally noisy at night.

The physical examination showed the following:

A middle-aged, fairly well-developed but poorly nourished mau; weight, 130 pounds. Tongue covered with a brownish coating. The pupils are equal and react promptly to light and accommodation. There is a tendency to nystagmus in the horizontal movements of the eyes. Knee-jerks slightly exaggerated on the right, the left about normal. The tongue protrudes in the median line and has a fine tremor. There is a tremor of the lips when the teeth are shown. The grasps are very weak, and the muscular power of the extremities shows considerable weakness of the extensor muscles, the feet drooping as the patient lies in bed. He is unable to stand without support and complains of feeling dizzy. The examination of the chest shows a marked lack of expansion on the left side, with dulness in the region of the lower lobe, almost complete absence of breath sounds, and diminished vocal resonance. Pulse 100 and weak. Arteries everywhere thickened. Hands and feet cold. The urine showed a trace of albumin, diminished indican, and a few hyaline casts. Stools daily and regular. Occasionally the evening temperature rose to 100°. He gradually grew weaker, with continued fever and increasing delirium. On November 14th there was marked dyspnæa, and examination of the lungs showed complete dulness in the lower part of the chest, with diminished vocal fremitus. The chest was aspirated and about 1500 c.c. of a clear, amber fluid withdrawn, which resulted in considerable relief of the dyspnea. On November 17th the knee-jerks were found to be absent

and the muscles showed considerable wasting, although the electrical reactions were normal. The fever continued, occasionally reaching 101° F., and on December 1st there was a return of the dyspnœa. The physical examination of the lungs showed the same condition as previously. The knee-jerks were still absent and the atrophy of the leg muscles more marked, the circumference of the left leg being from 1 cm. to 2 cm. less than on the right. There was some pain and tenderness over the nerve trunks. The left pleural cavity was again aspirated on February 10, 1903, and about 400 c.c. of a clear fluid withdrawn. This was repeated on March 2d, and 1800 c.c. of an amber serum aspirated. From the time of admission up to May, 1903, the patient lost twenty pounds in weight. The mental and physical condition remained unimproved. On May 26, 1903, 1050 c.c. of fluid was again aspirated from the left side of the chest, and it was this fluid which I had the opportunity of examining.

Analysis of the Pleuritic Fluid. Amount, 1050 c.c.; color, greenish-yellow and semi-opaque; specific gravity, 1027; odor, none; reaction, neutral. The amount of sediment was small. On standing in a tall, cylindrical litre graduate for twelve hours it did not occupy more than $\frac{1}{2}$ cm. The microscopic examination showed a fair number of normal pus cells, the absence of cholesterin crystals, and a few blood cells (con-

tamination from aspiration with the trocar).

Fibrin was absent. There was no spontaneous coagulation. On heating there was a fairly firm coagulation of serum albumin and globulin. On adding 10 per cent. acetic acid in the cold there resulted a fair precipitate of nucleoproteid. A portion of the fluid was made slightly acid with acetic acid and the other proteids removed by boiling. The filtrate was slightly cloudy, which cloudiness could not be removed by continued filtration. Tests for serum albumin and globulin and nucleoalbumin showed all to be entirely absent.

On the addition of a few drops of nitric acid to the filtered fluid there resulted a heavy white precipitate, not soluble in excess of the acid, but which completely cleared up on heating and reappeared on cooling with the simultaneous appearance of the xanthoproteic reaction. The same reaction was obtained with sulphosalicylic acid. The amount of this albumose-like body was large and reached 4 per cent. in the Esbach albuminometer. As this substance was undoubtedly an

albumose, its further investigation was decided upon.

Repeated examinations of the urine showed it to be free from both albumin and albumose. Further examination of the patient revealed extreme tenderness on pressure over the sixth to the tenth ribs on the left side, with some crepitation under the skin, but without any herpetic eruption. No nodules or swellings were felt along the line of the ribs, and the long bones of the legs and arms were free from pain, both to pressure and percussion. A few days later this tenderness disappeared. There was no evidence of anemia, and the blood examination showed: Hæmoglobin, 100 per cent.; erythrocytes, 4,800,000; leucocytes, 7640.

Reactions of the Native Fluid. A portion of the fluid was diluted with water, and 10 per cent. acetic acid added to a slightly acid reaction. There resulted a moderate precipitate of nucleoproteid. The fluid was then heated upon the water-bath until the native albumin was coagulated and the rather heavy coagulation filtered off by aid of an exhaust

filter. The slightly cloudy filtrate was found to be free from serum albumin and globulin and nucleoproteid. This native fluid responded

to the following reactions:

On heating there resulted a slight milkiness at first, but the fluid rapidly became opaque. As the boiling point was reached white flakes appeared in a clear liquid, which rapidly settled to the bottom of the tube as a fine, flocculent precipitate, which did not increase on cooling. Heller's test was positive, a broad white ring.

On the addition of a few drops of nitric acid a heavy white precipitate formed in the cold, which did not dissolve in excess of the acid, but almost completely disappeared on boiling (the fluid at the same time turning yellow), and reappeared on cooling as a granular, yellowish precipitate. This turned to orange on the addition of a strong alkali

(xanthoproteic reaction).

Hydrochloric acid produced the same result, with the exception that on heating the precipitate at first grew more dense and then disappeared as the boiling point was reached. Sulphuric acid produced a similar reaction. With phosphoric acid there was a white precipitate in the cold, which did not disappear on heating. Sulphosalicylic acid produced a heavy white precipitate in the cold, which disappeared on heating and reappeared on cooling. It was noted that the reaction was more marked in this case than with any other acid reagent.

On the addition of acetic acid even in excess the solution remained clear, both in the cold and on heating. Tannic acid caused a heavy, yellowish-brown precipitate, which grew more dense on heating. Both picric acid and Esbach's reagent caused a heavy yellow precipitate,

which did not disappear on warming.

The addition of phosphotungstic acid in the presence of a few drops of hydrochloric acid caused a heavy, white precipitate, which curdled on heating, but did not disappear. Acetic acid and potassium ferrocyanide produced a heavy precipitate, which grew more dense on heating.

On the addition of Lugol's solution no precipitate was obtained. Alcohol precipitates the substance as a flocculent mass readily soluble

in very dilute ammonia or sodium-carbonate solution.

The resulting solution gives the albumose reactions with sulphosalicylic and nitric acids. Millon's reaction, intense brick-red; Adamkiewicz reaction, deep purplish-red; xanthoproteic reaction, strong; Molisch's reaction, the sulphuric acid turns green almost immediately, and on standing a short while a purplish-red ring forms at the junction of the acid and the fluid; biuret reaction, intense purplish-red reaction with the native fluid.

To another portion was added phosphotungstic acid and a few drops of HCl, the resulting heavy, white precipitate washed with absolute alcohol, dissolved in weak sodium-hydrate solution, and heated until it became colorless. On the addition of a few drops of a weak coppersulphate solution to this fluid a purplish-red biuret reaction resulted. The solution remained clear on the addition of an excess of a saturated sodium-chloride solution. On heating there was a very slight turbidity, but no precipitate resulted. This turbidity could not be removed by filtration. In the presence of a few drops of 10 per cent. acetic acid, however, a saturated salt solution caused a heavy, white precipitate, which did not disappear or grow less on boiling. Saturation with sodium

chloride in substance or with rock salt did not cause a precipitate at room temperature until the point of saturation was reached. This was hastened by warming. Saturation with magnesium sulphate in the presence of acetic acid caused a complete precipitation of the substance.

The addition of twice the amount of a saturated solution of ammonium sulphate to the neutral fluid caused a complete precipitation of the body. The substance was not dialyzable and could not be precipitated

by dialysis, even from salt-containing solutions.

After coagulation by heat the coagulum went into clear solution on warming with distilled water to which was added a little sodium carbonate or acetic acid. From this solution it could be precipitated by alcohol. The substance could not be precipitated from its acid solutions on neutralizing with ammonia or even when it was added in excess. The neutral solution remained clear, even on largely diluting with water. On passing CO, through the neutral solution no precipitate resulted. Gravimetrically, the amount of the albumose was 4.36 per cent. The sulphur test was marked: a dark brown color which rapidly became black, and, finally, a black precipitate.

Coagulation Temperature. There was a slight beginning opalescence at 43.5° C., which became more marked at 50° C. The solution began to be turbid at 65° C. and opaque at 67° C., so that the bulb of the thermometer could scarcely be seen. Flocculi began to separate at 69° C., and at 69.5° C. these flocculi rapidly settled to the bottom of

the tube and assumed a granular appearance.

Crystallization. On slow precipitation by gradual heating the substance became granular in appearance, and under the microscope could be found a large number of gleaming white oval and round spheroliths resembling leucin. In many of these could be seen concentric and radiating lines. These crystals were easily soluble in dilute hydrochloric and acetic acid and in sodium carbonate. No crystals could be obtained when the native solution was allowed to stand for several days or to slowly evaporate. A portion was precipitated with a saturated solution of ammonium sulphate and evaporated over calcium chloride, but crystallization failed to take place.

Reactions of the Isolated Substance. To another portion of the fluid there was added twice its volume of a saturated solution of ammonium sulphate. The resulting heavy precipitate was filtered off, dissolved in hot water, and dialyzed for some time. Even on prolonged dialysis, however, it was found impossible to get rid of all the salt. The most delicate tests failed to show that the substance was dialyzable, and neither was it precipitated as the amount of salt grew less. The solu-

tion had a slight opalescence and was neutral in reaction.

It responded to the same color and precipitation tests as the native substance and also crystallized on slow heating, the crystals again resembling leucin. The reaction to various salts both in solution and in substance was likewise identical, and the coagulation point was at the same temperature. Evidently the trace of ammonium sulphate that was present and could not be removed by dialysis did not influence the various reactions, crystallizations, or coagulation point.

The following reactions, however, may be especially noted:

No precipitate occurred either on largely diluting with water or ou the passage of CO₂ through the liquid. On adding Lugol's solution, no precipitate. On adding an equal quantity of a saturated sodium-chloride solution there is no precipitate in the cold and only a slight opalescence on heating, which cannot be removed by filtration. If the same process be repeated with the addition of a few drops of acetic acid there results a heavy, flocculent precipitate in the cold, which grows more dense on heating. Saturation with sodium chloride in substance or with rock salt causes a partial precipitation, which becomes complete on the addition of a few drops of acetic acid. If coagulated by heat the coagulum dissolves readily, forming a clear solution on the addition of a few drops of acetic acid or of a saturated solution of sodium carbonate. It can be precipitated from either of these solutions by neutralization with sodium carbonate (if acid) or with acetic acid (if alkaline), as the case may be.

Elementary Analysis. For elementary analysis and digestive experiments the albumose was precipitated with alcohol, the resulting precipitate washed several times with 95 per cent. alcohol, then absolute alcohol and ether, and dried over calcium chloride. The substance purified in this manner was almost pure white and responded to the following reactions when dissolved in dilute ammonia, in which it was readily soluble: Biuret reaction, rose-red; Millon's reaction, intense vermillion-red; xanthoproteic reaction, marked; Molisch's reaction, purple at junction, the acid turning green; Adamkiewicz reaction, marked purplish-red; sulphur reaction, moderate; nitric acid, white precipitate, which completely disappears on heating and reappears on cooling; sulphosalicylic acid, same as with nitric. With the pure dried substance Lieberman's reaction gave a deep lilac color. The amount of nitrogen was 15.4 per cent. Both phosphorus and the xanthine bases were absent, but there was a trace of iron. Sulphur was present.

On warming a portion of the substance for an hour with dilute hydrochloric acid there was obtained a reducing body which gave marked reactions with Fehling's and Nylander's solutions. With phenylhydrazin and sodium acetate there was obtained an osazone which crystallized in long and rather broad, yellow needles, but in too small an amount to determine their melting point. The hydrochloric acid

phloroglucin test was negative.

Behavior on Digestion. On digestion with trypsin in a slightly alkaline medium at 40° C. for forty-eight hours the substance went into complete solution. No neutralization precipitate was obtained with acetic acid. The test for protein chromogen with bromine-water was well marked, and there was a large yield of tyrosin and but little leucin. The leucin and tyrosin were identified by their crystalline form and the latter in addition by its intense Millon reaction. I regret that my material was not sufficient for peptic digestion.

From the above reactions we can conclude that the pleuritic fluid contained the so-called albumose of Bence-Jones, which was formerly thought to occur only in malignant bone disease, but which later inves-

tigations have shown to be present in other conditions.

There have been reported cases of albumosuria associated with various neuritic disorders or with vague symptoms referable to the nervous system, and some of these at least seem to have been free from any bone or marrow disease.

Senator's ease², in addition to a multiple sarcomatosis, had central hypoglossus and trigeminal paralysis, with great weakness and sensitiveness of the left peroneal and tibial nerves. The tongue was especially involved. The autopsy showed multiple myelogenous round-eelled sarcoma of the ribs, double-sided fibrinous pleurisy, and chronic parenchymatous nephritis with amyloid degeneration. The brain showed no abnormality, and the medulla exhibited only an irregular distribution of the nuclei. In the urine, which was examined by Rosin,³ large quantities of albumose could be demonstrated.

In Wright's case4 there was numbness of the feet, double vision, and strabismus. Hamburger's first case⁵ had frequent attacks of facial neuralgia. Boston's case suffered from gastrointestinal catarrh and peculiar nervous phenomena, attacks of obstinate constipation, radiating pains, vomiting, edema, frequent attacks of urticaria, various paræsthesias, loss in weight, and marked anæmia. It is merely mentioned that the Bence-Jones body was present in the urine and that its elimination was intermittent in character. No chemical details are given. Anders and Boston later report three eases in which the Benee-Jones albumose was found in the urine. Saturation with sodium ehloride in neutral solutions eaused a precipitate in but a portion of the substance, thus differentiating it from protoalbumose and hetero-The first case had cranial and facial neuralgia, the second suffered from various paræsthesias and neuralgie pains in the lower limbs, while in the third ease there was paralysis of the left side of the face. The authors contend that the body is more or less closely allied to peptone, globin, histon, and the digestive albumoses.

Since Simon collected the literature in 1902 there have been reported additional cases of Bence-Jones albumosuria associated with symptoms referable to the osseous system or to the blood. One of these (Jochmann and Schumm) is a further report of the urinc and post-mortem findings of a case already published. In Simon's case⁸ there was pain along the course of the eighth and ninth ribs, with extreme tenderness, and followed shortly afterward by a tumor mass, the size of a lima bean, near the sternal end of the eighth rib. There was marked anomia and great loss of weight. For three months before death there existed extreme pain of the left thigh, and five days before exitus spontaneous fracture of the left femur occurred. Death ensued a year after the onset of the first symptoms, but the partial autopsy that was allowed revealed no abnormality of the ribs. The diagnosis of multiple mycloma was made at the beginning of the disease on the basis of the urinary findings. There was polyuria, low specific gravity, acid reaction, and the sediment was free from casts. Heated to 55° C. the urine yielded a heavy, white precipitate, which became a little clearer on boiling, to grow more turbid on cooling, and which again became clear

on the addition of a few drops of acetic acid. Nitric acid yielded a precipitate which completely dissolved on boiling and reappeared on cooling. The urine gave a strong biuret reaction. By Esbach's albuminometer the amount of proteid was 0.27 per cent. The author undertook an elaborate chemical study of this substance and concluded that it was closely related to the globulins, if, indeed, it is not a globulin itself. The body showed many points of resemblance with Nöel-Paton's crystalline globulin and with Marcus' water-soluble globulin. He argues strongly against the purely albumose nature of the substance.

In Gutternik's and de Graff's case⁹ the albumin could be crystallized, and the authors refer to it as a crystalline urinary albumose. This, including Nöel-Paton's and my own, makes three cases in which the substance could be obtained in crystalline form.

Vickery's case¹⁰ was one of albumosuria occurring in the course of a pernicious anæmia without any symptoms or abnormalities referable to the bones. The urine was examined by Wood. By the heat test there formed an abundant precipitate which dissolved on boiling and reappeared on cooling. No attempt was made to further identify the nature of this albumose-like body.

Jochmann and Schumm" report the case of a woman, aged thirtyseven years, which, in a preliminary communication, was called osteomalacia,12 but later, after an elaborate study, the diagnosis was changed to multiple myeloma. During life the case was submitted to a careful X-ray examination. The Bence-Jones albumose was present in the urine, and Schumm gives an extensive chemical study of the body, arriving at the conclusion that it is not a true albumose, but stands midway between albumose and albumin. He was able to demonstrate the presence of an albumose-like body in the blood, which resembled deuteroalbumose and did not give the histon reactions. Barr13 reports a urine that contained a proteid which coagulated at 60° C. and could be precipitated by mineral acids, but was soluble in excess. It could be precipitated by ammonium sulphate, but not by magnesium or sodium sulphate. The amount of proteid varied from 1.2 per cent. to 2.4 per cent. The reactions given, however, do not prove the identity of this substance with the Bence-Jones albumin.

In Milroy's case¹⁴ there was a knotty swelling under one of the ribs which appeared like a new-growth. The urine, when made weakly acid with acetic acid, gave a precipitate by warming at 52° C., which thickened to a coagulum and dissolved largely at 95° C. It reappeared again on cooling. The amount of this proteid was 0.54 per cent. The urine gave the biuret, Millon's xanthoproteid, and sulphur reactions, but phosphorus was absent. Saturation with sodium chloride or with magnesium sulphate gave a very slight precipitate. Nitric acid

gave a precipitate in the cold which dissolved on warming and reappeared on cooling. By repeated precipitation with ammonium sulphate, the behavior of the substance on warming was not changed. If the urine was warmed rapidly to 100° C, the substance did not appear on cooling. When the urine was saturated with sodium chloride and then heated the entire mass coagulated. It was impossible to crystallize the proteid. The substance as a whole appeared to resemble a deuteroalbumose, but behaved differently on warming.

In Simon's case of læukemia¹⁵ with atypical blood findings (absence of eosinophilic leucocytes) the Bence-Jones albumin could not be demonstrated in the urine, even on repeated examinations.

In addition to the above, in the urine of a case of puerperal delirium associated with an acute parenchymatous nephritis with occasional hemorrhagic exacerbations, and having a freezing point varying from 0.15° C. to 1.6° C., a high percentage of albumin, many casts, and a low chloride and urea elimination, I found large amounts of an albumose which gave the following reactions: Nitric acid, heavy, white precipitate in the cold, disappearing on heating and reappearing on cooling; sulphosalicylic acid, the same as with nitric acid, but more marked; biuret reaction, rose-red; sulphur test, marked; Molisch's reaction, marked; xanthoproteic reaction, strong; Millon's reaction, marked.

The addition of acetic acid causes no precipitate, either in the cold or on heating. With alcohol there arises a white precipitate which is easily dissolved in weak sodium carbonate, and the resulting solution gives the biuret reaction. My investigations on this case are not sufficiently mature to warrant further detail.

The proteid substance found in the urine of the various cases cited was of an albumose nature, yet the finer chemical details differ somewhat. They were all associated with some profound metabolic disturbance, manifested clinically by either abnormal blood states, new-growths in the bones, or by various trophic or neuritic disorders. The reaction to mineral acids (especially nitric) seems to have been identical in all the cases. The slight variations occur in their physical states or in their composition on elementary analysis, but even the latter shows a remarkable resemblance, as will be seen from the following analyses of various observers:

ELEMENTARY COMPOSITION.

Observer.			N.	s.	P.	Fe.
Benee-Jones			. 15.03	Present.	Present.	•••••
Kühne			. 16,55	44	*****	********
Nüel-Paton .			. 16.06	44	Absent.	•••••
Neumeister.			. 15.55	£1	"	Trace.
Simon		. 1	15.12-15.26	41	4.6	********
Coriat			. 15.4	£1	• •	Trace.

The presence of the carbohydrate group is a prominent characteristic and is probably related to the hexoses, as it failed to give the reaction for pentoses with the phloroglucin-hydrochloric acid test. Pick, moreover, speaks of his fraction III. as containing a carbohydrate molecule and calls it a glycoalbumose, yet this group was present in his other secondary albumoses, although in a smaller amount. This fraction resembles my substance by its positive Molisch test, yet, on the other hand, differs from it in various precipitation and color reactions.

The Bence-Jones body is also to be differentiated from various other proteids and albumoses, and the essential points may be stated as follows:

Histon is an albumose-like body found by Kossel in the red blood corpuscles of geese and also in febrile and leukæmic urine. It does not exist as such in the cells, but in combination with another body, presumably nuclein. It contains 16.7 per cent. to 17.93 per cent. nitrogen, according to various observers. When treated with alcohol it becomes insoluble in sodium carbonate or dilute acids, it is precipitated by CO₂ from neutral solutions and by ammonia from acid solutions, and is insoluble in excess of the reagent.

Heteroalbumose is precipitated by saturation with sodium chloride in neutral solutions, yields but little tyrosin on tryptic digestion, and contains 17.98 per cent. nitrogen. It is also precipitated on dialysis and does not contain a carbohydrate group in its molecule.

Protoalbumose is dialyzable to some extent, but is not precipitated on dialysis. It is non-crystalline and gives only a faint Adamkiewicz reaction, does not contain a reducing body, and is only partially precipitated by sodium chloride from its neutral solutions.

Serum globulin coagulates at 75° C., is precipitated by diluting its salt-containing solutions with water, on dialysis after precipitation with various salts, by passing a stream of CO₂ through its solutions, by half saturation with ammonium sulphate, or by complete saturation with sodium chloride. According to Mörner, it yields a reducing body on boiling with dilute acids.

With the ordinary albumins it has nothing in common. Peptone is not precipitated by nitric acid or on saturation with ammonium sulphate.

Deuteroalbumose is an anticompound, and does not yield any amidoacids on tryptic digestion. It is precipitated by sodium chloride only on the addition of acetic acid, and does not give the nitric-acid reaction except in the presence of an excess of salt, and is dialyzable to some extent.

The substance in my case gave all the ordinary albumose reactions, but unlike the albumoses it could be crystallized, and yet resembled the colloids in not being dialyzable, while protoalbumose and hetero-

albumose are dialyzable to some extent. It seems to have existed in the fluid in a peculiar physical condition, as in Nöel-Paton's crystalline globulin, or in Cramer's three cases of emulsion albuminuria.18 on congulation by both heat and alcohol it was capable of being easily dissolved by very dilute acids or alkalies and forming a clear solution, while histon is insoluble under the same conditions. Furthermore, unlike histon, it could not be precipitated by ammonia from its acid solutious. The Molisch reaction was positive, and the carbohydrate group present seemed to be related to the hexoses, while both protonlbumose and heteroalbumose have no carbohydrate group in their molecule. differs from protoalbumose and heteroalbumose in being precipitable by saturated solutions of sodium chloride only in the presence of acetic The coagulation temperature was a definite one. Both phosphorus and the xanthin bases were absent, proving that the substance had no relation to the nuclein group. That it is a hemibody is shown by the large yield of tyrosin on tryptic digestion, while denteroalbumose, the substance which the Bence-Jones albumin most resembles. is an antibody and does not yield the amido-acids when digested with trypsin. The behavior on boiling has been noted differently by various observers; with some, the substance almost completely dissolved; in Nöel-Paton's case there was complete coagulation, while in Simon's and my own case there was no evidence of clearing, even when the boiling point was long sustained, but it is noteworthy that in both cases the coagulum was capable of easy solution.

The exact nature and origin of the Bence-Jones substance has been the subject of much contention. Simon believes that the body is closely related to the globulins; Huppert looks upon it as a heteroalbumose; while Kühne and Chittenden found that on elementary analysis the body resembled heteroglobulose, and they suggest that it may arise from serum globulin. Magnus-Levy, on the other hand, did not believe that it belonged to the globulins, on account of its behavior to mague-sium sulphate.

There is no reason to believe that the substance is formed in the kidneys, but it is eliminated by these organs when abnormally present in the blood; yet here again direct proof is wanting as to the origin of the substance in that medium. Schumm was able to demonstrate in the blood of his ease a body which resembled a deuteroalbumose. Following the introduction of the isolated body into the blood of animals it rapidly appears in the urine. The presence of an albumose-like substance in normal bone-marrow proves nothing, but it is interesting to note that both Wood and Ellinger have found, in the affected portion of the marrow in malignant bone disease, a proteid which gave all the albumose reactions. That the substance arises as the result of peptic or tryptic action upon ingested albumins, and then passes into the

blood stream, where, as a foreign substance, it is eliminated by the kidneys, is not to be thought of, because, as has been previously shown, the Bence-Jones albumin possesses nothing in common with the ordinary digestive albumoses. Simon claims that it is probably derived from the common albumins of the blood, in all probability the serum globulin, through the enzymotic action of the plasma cells of the bone-marrow, in cases of myeloma, and from thence passes into the urine. the light of my own case, is at least very suggestive if not convincing. Up to this time, however, no case had been reported where the Bence-Jones albumin could be demonstrated in a pleuritic effusion, its occurrence being confined to the urine, blood, and bone-marrow. As a small amount of pus cells were contained in the pleuritic fluid of my case, it must necessarily have been of inflammatory and probably also of bacterial origin, as shown by the clinical course of the disease. we look upon the pleuritic effusion as being in reality an exudate from the blood, the origin of this substance is probably from the same source. and can be referred to the action of enzymes contained either in the leucocytes or in the micro-organisms upon either the serum albumin or serum globulin. The process is really a digestive one upon the ordinary albumins of the exudate, which have the same composition and ratio as the proteids of the blood, but which, as the result of this digestive action, have in part been changed to an albumose having all the characteristics of the Bence-Jones body, and existing in the fluid in an unusual physical state. But whether this action is principally upon the serum albumin or serum globulin, or both, cannot be definitely decided at present. In confirmation of the above, Fermi and Pampersi¹⁹ have shown that bacteria contain a proteolytic enzyme whose action upon proteids resembles that of trypsin. According to Austin,20 the prolonged action of micro-organisms on nucleins, fibriu, and probably on other proteids, produces protoalbumoses and heteroalbumoses and secondary albumoses, A, B, and C, according to Pick's scheme, but no These albumoses simulate those produced by trypsin.

In the light of this recent work it is easily conceivable how an albumose having all the peculiar characteristics of the Bence-Jones body could arise in this manner from the native blood proteids as they were exuded into a pathological pleuritic fluid. The medullary theory of the origin of the substance cannot be sustained, because there is not sufficient bone-marrow, even if all were involved, to account for the large amounts of albumose present in the various cases. In my case, at least, the rib tenderness was not sufficiently prominent to be suggestive of malignant bone disease.

In conclusion, it may be stated that the substance in my case was pre-eminently of an albumose nature, although probably not a true albumose, and having all the characteristics of the Bence-Jones albumin,

but existing in the pleuritic fluid in an unusual physical state. It evidently was not absorbed and did not pass into the blood stream, as not even a trace of the substance could be detected in the urine. Furthermore, it seems to be a derivative of the digestive action of either the leucocytes or the bacteria upon the proteids in the effusion which are derived directly from the blood. Its origin can probably be traced to serum globulin rather than to serum albumin, as it possesses many features in common, both in reaction to various reagents and its composition on elementary analysis to Marcus' water-soluble globulin. The nitrogen content is about the same in both; neither are precipitated by dialysis or on the passage of CO₂ through their solutions, and both give the sulphur, biuret, xanthoproteic, Adamkiewicz, and Molisch reactions.

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MULTIPLE MYELOMA (MYELOMATOSIS), WITH BENCE-JONES PROTEID IN THE URINE.

(MYELOPATHIC ALBUMOSURIA OF BRADSHAW, KAHLER'S DISEASE.)1

By F. Parkes Weber, M.D., F.R.C.P., Physician to the german hospital.

WITH A REPORT ON THE CHEMICAL PATHOLOGY.

BY R. HUTCHISON, M.D.,

AND

J. J. R. MACLEOD, M.D.

THE patient, J. T., aged fifty years, a stoker, came under my observation at the German Hospital in May, 1900, but I did not make the diagnosis of multiple myeloma until the following July, when I happened to examine the urine by the ordinary methods. From May to July the Bence-Jones proteid in the patient's urine had been frequently, at one time daily, measured by Esbach's albuminimeter, but had been entered in the notes as ordinary albumin. The daily amount of urine was found to be about 2000 c.c., and it contained about 7 per mille of the proteid. The reactions were quite typical, just as those described by Bradshaw, Kühne, Bence-Jones, and others. The most characteristic are, I think, the following (that is, when the urine is acid): Coagulation of the proteid at a much lower temperature (about 58° C.) than ordinary albumin, more or less solution of the precipitate at a higher temperature (e. g., when the urine is boiled), and complete or almost complete solution on adding acetic acid to the boiling urine; after the precipitate has been partially redissolved by boiling, a characterisic reprecipitation should take place on allowing the urine to cool. What Dr. Bradshaw considered to be the spontaneous precipitation of the proteid in his case (noted also in some other cases) was likewise observed in the urine of the present case. The urine sometimes was turbid with this precipitate when quite freshly passed, and on these occasions, the reaction being always very acid, the turbidity could not have been due to phosphates.

Summary of the Present Case.

The patient, a rather fat man, aged fifty years, complained of rheumatoid symptoms, commencing, so he thought, about the end of the

¹ Founded on a communication to the Royal Medical and Chirurgical Society of London, March, 1903.

² On account of the contention by A. Magnus-Levy (Hoppe-Seyler's Zeit. f. Phys. Chemie., Strasburg, 1900, vol. xxx. p. 200) that the so-called Bence-Jones albumose is really an albumin, I have referred to it in this paper as Bence-Jones proteid. For the sake of brovity, however, I have sometimes spoken of "Bence-Jones albumosuria" when I meant to signify the presence of Bence-Jones proteid in the urine. It seems that precipitin experiments fail to solve this question of the nature of the Bence-Jones proteid. In fact, the so-called "hiological method" fails to distinguish the Bence-Jones proteid from various other proteids of human origin. *Vide* Rostoski, Zur Kenntniss der Präcipitine, Verhandl. der phys.-med. Gesellschaft, Würzburg, 1902, vol. xxxv. pp. 30–32.

² The urine is nearly always acid in Bence-Jones albumosuria.

year 1899. About February, 1900, he began to suffer from pains in his loins and stiffness in the small joints of his hands. Soon afterward the upper part of his back began to bend, so that he always had a stooping attitude. Previously to this illness the patient had been strong, but as a young man had had gonorrhea and a chancre on the penis. One of his sisters suffered from diabetes mellitus.

The urine of the patient was found to contain the Bence-Jones proteid. The daily amount of the urine was about 2000 c.c., and it contained about 7 per mille of the proteid as measured by Esbach's albuminimeter. By a more exact method (precipitation with alcohol, drying, and weighing) Dr. R. Hutchison found that about 15 grammes of the proteid were excreted daily. The reactions of the proteid were the typical ones described by Bence-Jones, Kühne, Bradshaw, etc.

For some time the patient's condition remained fairly stationary, and at first, by the use of local hot baths, massage, etc., the power of bending his fingers was improved. Afterward, however, the general weakness, cachexia, and anamia greatly progressed, and gummatous disease of the tongue and over one rib made its appearance. Examination of the blood showed great anamia and slight leucocytosis. On January 25th the patient died after copious hemorrhage from the intestines, which post-mortem examination showed to be due to chronic ulceration of the duodenum. The Bence-Jones albumosuria persisted to the last.

At the necropsy the bone-marrow of all the bones examined was found to be more or less affected by a diffuse sarcoma-like growth of rounded or polyhedral mononuclear cells—a form of "multiple myeloma" or "myelomatosis." There were no localized outgrowths projecting from the bones, such as have been noted in some cases of multiple myeloma, and no other parts of the body were invaded. fact, as the neoplasm was strictly limited to the osseous system, no parts of it could be regarded as metastatic. The presence in the tumor cells of certain granules and globules of various sizes constituted a striking histological feature in the present case. Professor R. Muir, of Glasgow, who made a careful histological examination of the growth, concludes "that the tumor is formed by a special and characteristic type of cell, which is probably derived either from the neutrophile myelocyte or its predecessor; that this cell produces in its protoplasm in a granular form a substance which is closely allied to though not quite identical with the substance of the neutrophile granules; and that this substance is formed in excess, and may form larger granules by confluence of the smaller, the larger globules sometimes becoming free."

According to J. H. Wright's report on a case examined by him, the principal tumor cells in the case in question appeared to be a variety of Unna's "plasma cells." Dr. J. M. H. MacLeod has kindly examined sections from the present case to compare the cells with Unna's plasma cells. He has used the special methods of staining for this purpose, and tells me: "Morphologically the cells resemble plasma cells in that they are polyhedral and their nucleus is placed excentrically. The nuclei, however, do not show the characteristic arrangement so gener-

¹ Johns Hopkins Hospital Reports, 1900, vol. ix. pp. 359-366. (See Case No. 13 in the Summary of Cases at the end of the present paper.)

ally found in plasma cells of five or six deeply stained chromatin bodies around the periphery."

The Chemical Examination of the Organs (Report Contributed by R. Hutchison, M.D., and J. J. R. Macleod, M.D.).

Up to the present time only three cases have been recorded in which

a chemical investigation of the organs was made.

The first of these is by Ellinger, but the clinical history of the case shows it to have been of an unusually acute nature, and the symptoms scarcely typical of myelogenous disease.

The tissues examined were a piece of infiltrated rib, blood, and some

ascitic fluid.

In the case of the piece of rib, the following somewhat rough method was employed. The piece of rib was macerated with water, the resulting extract was filtered off, and to part of it was added some sodium chloride and acetic acid, whereby a precipitate was produced. another part of the watery extract the point of heat coagulation was determined and found to be 40° C.

The author mentions that a piece of normal rib-marrow treated in

the same way does not give these reactions.

In the case of the blood and ascitic fluid, a more reliable method

was employed.

To each was added an excess of alcohol, and the resulting precipitate was allowed to stand several days. It was then filtered off and macer-The resulting watery extract was then weakly ated with water. acidified with acetic acid and boiled. The boiling fluid was quickly filtered, so as to separate all coagulated proteid, and the filtrate, at first quite clear, gradually became cloudy on cooling, and gave the reactions for Bence-Jones proteid.

The second case is recorded by Askanazy,2 and is peculiar in that an examination of the blood during life, and of the lymphatic glands

after death, showed it to be one of lymphatic leukæmia.

The tissues examined were marrow from the vertebre and head of femur, lymphatic tumors, blood, pericardial and pleuritic fluids.

Two methods were employed in testing for the proteid. One of these consisted in making a watery or weak caustic soda extract of the tissue. This was then treated with acetic acid, so as to precipitate nucleoproteid, which was filtered off. In the filtrate the heat-coagulation point was determined. It was then boiled and filtered hot, the resulting filtrate being gradually cooled. The other method consisted in adding alcohol to the extract, collecting the precipitate, and macerating it with weak caustic alkali. The resulting extract was then treated with acetic acid to precipitate nucleoproteid, and to the filtrate from this were applied the tests for Bence-Jones proteid.

By means of these methods it was found that the Bence-Jones proteid was present in the marrow, but absent from the lymphatic tumors,

blood, and pericardial and pleuritic fluids.

The alcohol method was employed in a sample of urine containing the albumose, and was found to give reliable results.

Deut. Arch. f. klin. Medicin, 1899, Bd. lxii, S. 255. (See Case No. 9 in the Summary.)

² Ibid., 1900, Bd. Ixviii. S. 34. (See Case No. 16 in the Summary.)

The third case is that of Kalischer, and the tissues examined were marrow from the ribs and humerus. The examination was made by Prof. Löwy, but he could not find a trace of Bence-Jones proteid.

Methods Employed in the Present Case. In the present ease a very complete chemical investigation was possible, as we were fortunate in securing not only portions of all the organs, but also large quantities of bone from various regions. Two methods very similar to those described by Magnus-Levy were employed to detect the body.

The bones were crushed into fragments in a quartz crusher, the other tissues being chopped up into small pieces. Each was then ground up in a mortar with distilled water and the resulting pulp allowed to stand twenty-four hours. The extract was filtered off and the remainder again pounded in the mortar with distilled water, the

second extract, after filtration, being added to the first.

The resulting watery extract from each tissue was then carefully neutralized and divided into two equal parts. To one of these were added two volumes of a saturated solution of ammonium sulphate, and the mixture was allowed to stand twenty-four hours. The resulting precipitate was separated by filtration, washed with ammonium-sulphate solution, and suspended in water. After standing several days this suspension was filtered and the filtrate placed in a parchment dialyzer for several days in running water, and finally, for at least two days, in distilled water, which was frequently changed. After dialysis a precipitate invariably separated out (globulin), which was removed by filtration. The resulting filtrate was tested for Bence-Jones proteid. To the second portion of the neutralized watery extract twice its volume of spirit was added, and the mixture was then boiled (by which means the native proteids become coagulated, whereas the Bence-Jones proteid does not).2 The mixture was then filtered, and the precipitate, after being washed with boiling 66 per eent. spirit, was suspended in 1 to 2 per cent, ammonia and either left in this for several hours or heated on the water-bath, by either of which processes a solution of the albumose results, while the coagulated proteids remain unaffected.

The former of these methods we will designate the ammonium-

sulphate method, the latter the alcohol method.

These two methods were applied to urine containing the substance in question. The resulting solutions gave the chief reactions for

Bence-Jones proteid.

To serve as controls we also examined, by both methods, red marrow from the vertebræ of a healthy person, and, by the ammonium-sulphate method, red marrow from the ribs of a horse. In neither of these was any trace of Bence-Jones proteid's found.

Results. The following are the results obtained from the various

organs and tissues:

Marrow of Bones. The marrow contained in these was apparently of two types—namely, a pink, pasty mass in the head and lower ex-

Deut. med. Woch., 1901, No. 4, S. 54. (See Case No. 22 in the Summary.)
 Magnus-Levy. Hoppe-Seyler's Zeit. f. Phys. Chemic., 1900, Bd. xxx. S. 200.

³ In the case of the red marrow from the horse's rib, the extract by the ammonium-sulphate method contained a trace of albumin coagulating at 75° C. In the case of the human vertebrae by the alcohol method, the application of the nitric and hydrochloric acid tests produced an indefinite haze but no distinct ring, and no coagulation occurred on heating even to boiling temperature.

tremity of the femur and in the ribs, and a thin, red currant-jelly-like mass in the shaft of the femur. We therefore divided the bones into three groups, viz.: (1) vertebræ and ends of femur; (2) ribs; and (3) shaft of femur.

1. Vertebræ and Ends of Femur. The neutralized extract by the alcohol method was very opalescent, and could not be cleared by filtration. It was accordingly dialyzed for three days in tap water and for twenty-four hours in distilled water. A slight precipitate separated out, and on filtration a clear solution was obtained. In the dialysates

by both methods the following reactions were obtained:

Heat Coagulation. A coagulum was obtained at 70° C., which did not clear upon boiling. On filtering the boiling fluid the filtrate did not show any opacity on cooling. On the addition of one drop of 20 per cent. acetic acid to 30 c.c. of the fluid coagulation occurred at 50° C., but the precipitate did not clear up on boiling, although it appeared to do so to a certain extent, because of the coagulum separating out as flocculi on the surface.

Hydrochloric Acid. A distinct sharp ring was obtained.

Nitric Acid. A similar ring was obtained, which cleared up considerably on heating, reappearing on cooling.

Two volumes of a saturated solution of common salt and a few drops of

20 per cent. acetic acid. A precipitate.

A few drops of acetic acid and potassium ferrocyanide. A precipitate, not clearing on boiling.

Biuret Test. Violet reaction.

In the opalescent solution by the alcohol method the addition of one drop of 20 per cent. acetic acid produced a precipitate, soluble, however, in excess of the acid.

2. Ribs. By the alcohol method an opalescent fluid was obtained, which gave a very distinct precipitate on the addition of acetic acid. The opalescent fluid was dialyzed for several days and filtered.

The clear fluid by both methods gave the following reactions:

Heat Coagulation. Slight haze at 60° C., which did not clear upon

boiling.

Nitric and Hydrochloric Acids. A distinct ring was obtained with both of these reagents, which cleared up considerably on boiling, becoming more distinct on cooling. A slight haze was produced by adding 1 in 10 HCl to the fluid.

Acetic Acid, 20 per cent. A few drops of this produced a distinct

precipitate, insoluble in excess.

Biuret Test. Slight violet reaction.

The precipitate produced in the undialyzed opalescent solution by the alcohol method on the addition of acetic acid¹ was fused in a silver basin with caustic soda and saltpetre; the resulting mass was dissolved in water, acidified with nitric acid, and mixed at 60° C. with ammonium molybdate solution. No trace of phosphorus was found present.

3. Shaft of Femur. The extracts contained only the merest trace of a proteid, and the only reactions which gave anything were the ring

tests.

4. Kidneys. Slight rings were obtained with the acids, and on boiling the fluid became opalescent.

¹ The amount of precipitate used for this test was quite sufficient for the purpose.

5. Liver, Spleen, and Muscle. No trace of proteid was shown by

any reaction by either method.

- 6. Pericardial Fluid. Slight rings were obtained with the acids, and on boiling an opalescence was produced. Acetic acid produced no haze. The ammonium-sulphate method was alone employed, as only 45 c.c. of the fluid was examined.
 - 7. Bile. No trace of proteid.
- 8. Blood. Fifty-five grammes of clotted blood from the heart was examined. This was extracted with water and the extract examined by both methods. In neither case was the slightest trace of proteid obtained.

Consideration of Results. From an examination of these results it will be seen that in no organ or tissue could the presence of a proteid identical with that found by the same methods in the urine be demonstrated. In the case of the vertebræ and ends of the femur, however, a proteid giving very similar reactions was obtained. It will be noticed that the points wherein this differs most from the typical Bence-Jones proteid are the temperature at which it coagulates and the fact that it does not clear up on boiling. It will also be noticed that after the addition of the merest trace of acetic acid the point of heat coagulation was the same as that in a similarly treated extract from urine, but whereas the urinary coagulum cleared up at 90° C., that of the marrow did not do so, even on boiling.

Recent work by K. Spiro, Hammarsten, and others shows, however, that not only does the exact point of heat congulation vary considerably with the dilution and composition of the fluid, but also that resolution of the coagulum depends to a very large extent on the composition of the fluid in which it is suspended. In view of these facts it is impossible to draw any deductions as to the nature of the body from a consideration of the heat-coagulation point alone, and the mere fact that any proteid whatsoever should have been obtained after the processes to which the original extract was subjected shows in itself

that some unusual proteid existed in the tissues.

Nor could such a proteid be obtained by employing exactly the

same methods from normal red bone-marrow.

The neutralized opalescent solution obtained by the alcohol method gave a copious precipitate on weakly acidifying with acetic acid. This precipitate was soluble in excess of the acid. It was easily soluble in weak alkalies and gave the xanthoproteic and other reactions for proteids. This precipitate was not present in the dialysate obtained by the ammonium-sulphate method. From its reactions it would appear to be either an alkali albumin or a nucleoproteid. To decide this question it was tested for phosphorus, with a negative result. It is probable, therefore, that a certain amount of alkali albumin had been produced out of the alcohol coagula by boiling with dilute ammonia. After the separation of this by neutralization and dialysis, a clear

¹ Hoppe-Seyler's Zeit, f. Phys. Chemie., 1900, Bd. xxx. S. 182.

² Pflüger's Arch. f. d. ges. Physiologie, 1878, Bd. xviii. S. 65.

³ It was noticed, both in the case of the urine and of the vertebral marrow, that on allowing the extract to stand for four weeks in a stoppered bottle a sediment had settled down. This was filtered off, and the clear filtrate failed to give any reaction for proteids. The precipitate was insoluble in weak alkalies. The albumose-like body had evidently undergone a change on standing. There was unfortunately not sufficient material to reinvestigate this fact.

solution giving exactly the same reactions as the ammonium-sulphate extracts was obtained.

The extract obtained from the red currant-jelly-like marrow found in the shaft of the femur contained only the minutest trace of proteid.

The only other tissue from which a proteid-containing extract could be obtained was the kidney, and here only in the minutest trace. The pericardial fluid gave rather clearer reactions than the kidneys, a result in accordance with Ellinger's observations.

Conclusions Regarding the Scat of Production of Bence-Jones Proteid (Hutchison and Macleod).

The invariable, or almost invariable, occurrence of bone-marrow disease in cases of Bence-Jones albumosuria would seem to point out the seat of production of this unusual proteid; but yet, when one considers the enormous quantities excreted daily—15 grammes in the above case—it is at first sight difficult to conceive how such a source can be possible. Magnus-Levy calculates that the whole mass of the diseased red marrow could not contain more than 100 grammes of proteid, and argues that in his case, at least, where the daily excretion in the urine often attained 36 grammes, its derivation from the bones In support of this contention he points out that in was impossible. those cases where the total urinary nitrogen was estimated it was found that nearly 40 per cent. of this was excreted as Bence-Jones proteid. In a case investigated by Seegelken,2 however, only about 10 per cent. of the total nitrogen was so excreted. From a consideration of these facts Magnus-Levy supposes that the bone-marrow cannot be the seat of its production, but that it represents a non-assimilated digestive proteid. This want of assimilation he ascribes to the absence of some influence which the bone-marrow normally exercises on the metabolism of proteid, but which is wanting when the marrow is diseased.

In the above case, however, the results point to the bone-marrow as the seat of production, and the absence of any proteid in the extract from nearly all the other tissues and organs would tend to disprove Magnus-Levy's theory, for were this correct we should expect to find at least some of the unusual proteid present in those organs (muscles,

liver, etc.) where proteid metabolism is most active.3

The body was not found in the blood, and this was probably due to the fact that only a limited quantity was procurable for examination. Its presence in the kidneys was to be expected, since a certain amount of urine must still have been present in the tubules.

Remarks on Multiple Myeloma in General.

Multiple myeloma may be defined as a diffuse new-growth primarily involving the bone-marrow, especially that of the vertebræ, ribs, and sternum. and affecting males as or more often than females, and

² Deut. Arch. f. klin. Med., Bd. lviii. S. 276. (See Case No. 6 in the Summary.)

¹ Case No. 11 in the Summary.

³ It is certainly difficult to conceive how so much proteid could be derived from so small a source; but still, when we take into account other metabolic processes in the body, e. g., the occurrence of 30 grammes of urea in the urine and of only 2 grammes in the whole body, the result does not seem so surprising.

⁴ In the present case, however, and in some other cases (see Nos. 20 and 24 in the Summary), the bones of the limbs were likewise much affected. Doubtless if the whole skeleton had been

chiefly those past middle age. The disease nearly always remains limited to the osseous system, though by direct extension it may form localized outgrowths projecting from the bones. Owing to absorption of the hard, osseous tissue the bones become softened or friable, and are easily broken. The vertebral column and sternum are sometimes much bent, and the spinal cord may be affected by pressure, due to the curvature of the spinal column or to new-growths bulging into the spinal canal. Owing to the destruction of bone-marrow, the formation of blood is impaired, and anemia and progressive cachexia occur, doubtless in some cases favored by the circulation of a toxic proteid. I cannot help drawing an analogy between the bone disease, myelomatosis (i. e., multiple myeloma), on the one hand, and the skin disease, mycosis fungoides, on the other. In both cases the etiology, as well as the true nature of the new-growth, is obscure. For both diseases an infection theory has been propounded, making the new-growths allied to the class of infective granulomata; but at present the arguments in favor of any such infection theory are far from convincing. In myelomatosis there is a primary diffuse infiltration of the bone-marrow of a great part of the skeleton, followed in some cases by the formation of definite localized tumors growing from the bones; while mycosis fungoides usually commences as a diffuse infiltration of the skin (premycotic stage), and the localized tumors, which give the disease its name, begin to sprout out later on. This analogy may perhaps turn out to be a very superficial one, but in the present uncertainty regarding both diseases it is worthy of mention. In one important point the analogy is imperfect. The point is that while mycosis fungoides seems to be a single definite disease (morbid entity), different kinds of neoplasm have apparently been included under the heading "multiple myeloma."

Multiple myeloma is a term which has been employed to include various diffuse new-growths arising in the bone-marrow (i. e., myclogenic), and not giving rise to definitely metastatic growths in other tissues.1 After post-mortem investigations various names have been employed according to the histological features (and individual interpretations by observers) of the neoplasms, and particularly of the cell elements of which the tumors are formed. The tumors have been regarded as simple overgrowth of the cell elements of the bone-marrow, or as myelogenic sarcoma, endothelioma, perithelioma, plasmoma, etc. In my first case² of "multiple myeloma" I supposed the tumor

examined the long bones would have been found affected in some of the cases in which by the clinical symptoms the bone disease was supposed to be limited to the ribs, sternum, and vertebral column.

¹ See later on in regard to the lymphatic glands becoming affected in some cases.

General Lymphadenomatosis of Bones, One Form of Multiple Myeloma. Transactions of the Pathological Society of London, 1897, loc. cit. The patient is referred to later on as E. P.

formation to be an example of "general lymphadenomatosis of bones." Recent re-examination of old sections (stained by the ordinary methods) from the bone-marrow growth and from the affected glands has confirmed the view and made it practically certain that the growth in the glands is identical with that in the bones. The cells of which the growth consists resemble lymphocytes, except that very many of them have more protoplasm than ordinary small lymphocytes have. The larger cells are rounded, oval, or polyhedral, and the nucleus is often placed excentrically. Part of the sternum was fortunately preserved in glycerin and formalin in the Museum of the Royal College of Surgeons, and thus I have lately had an opportunity of examining sections of the sternal portion of the growth stained by Ehrlich's triacid and by Mann's eosin-methyl-blue combinations. These stains show that hardly any of the cells contain granules. In fact, only one or two coarsely granular eosinophile cells were seen in looking through the sections, and these were probably not tumor cells. The tumor may, therefore, be said to consist of non-granular, lymphocyte-like cells. The majority of these cells have more protoplasm than ordinary small lymphocytes have. It must be remembered, however, that in lymphatic leucocythemia the growths in the various organs may consist largely of cells which, though they are described as lymphocyte-like, have much more protoplasm than do the small lymphocytes of normal blood. Every intermediate form between the cells with much protoplasm and those with very little protoplasm can be found in the growths of lymphatic leucocythæmia, and so they can be in the myelogenic growth from the patient E. P. Moreover, in normal lymphatic glandular tissue many of the cells of the "germinating centres" have more protoplasm than the small lymphocytes, further from these centres, and in the circulating blood. I feel justified, therefore, in saying that in the case of E. P. the cells of the myelogenic growth were lymphocyte-like, if not actually of the lymphocyte kind. Dr. J. M. H. MacLeod has kindly examined the growth by special staining for plasma cells, and thinks that the cells of which the growth is composed have a greater resemblance to lymphocytes than to the typical plasma cells of the granulomata.1

Two types, if not more, of "multiple myeloma" are to be distinguished: (1) a growth, as in the patient, J. T., in which the bonemarrow only is involved; (2) a growth in which nearly all the cells resemble small or large lymphocytes, and are possibly derived from the non-granular predecessors of the myelocytes; in this second type

¹ I may add that in part of the growth in the sternum many of the tumor cells have undergone some kind of a degenerative change, owing to which, by Mann's eosinmethyl-blue combination, the nucleus and the rest of the cell are deeply stained by the eosin.

² A. Pappenheim. Virchow's Archiv, 1902, vol. clxix. p. 381. According to his views, the large lymphocyte type of cell, which in the lymphatic glands gives rise to the ordinary small

of "multiple myeloma" lymphatic glands as well as bone-marrow may probably be affected. The second type of multiple myeloma would include cases described as myelogenic lymphosarcoma, myelogenic lymphadenoma, and myelogenic pseudoleukæmia (using the German term "leukæmia" in the limited sense of "lymphocythæmia)." Intermediate cases between these two types ("mixed forms") probably also occur.

If the views which I have suggested in this paper be correct, it follows that the whole class of leukæmias and pseudoleukæmias (using the German terms for convenience) can be divided into at least the following six types, independently of intermediate forms:

- (a) A new-growth of lymphocyte-like cells originating in the bone-marrow and not overflowing into the circulating blood. Myclogenic pseudoleukæmia (using leukæmia in the sense of lymphocythæmia), myclogenic lymphosarcoma, lymphadenomatosis of bones, multiple mycloma (myclomatosis) of the lymphatic type.
- (b) Similar to the preceding, but the lymphocyte-like cells overflow into the blood stream. Myelogenic lymphocythæmia. I do not know of any cases illustrating this type excepting cases of "acute leukæmia." Those of A. Dennig (Münchener med. Wochenschrift, 1901, No. 4, page 140) and C. H. Melland (Medical Chronicle, September, 1902, page 372), for instance, were examples of acute lymphocythæmia in which post-mortem practically no change was discovered in leucocyte-forming tissues other than the bone-marrow.
- (c) A new-growth formed in large part of lymphocyte-like cells originating in the lymph glands or the lymphadenoid tissues generally, and not to any great extent overflowing into the circulating blood. Lymphatic or splenic lymphadenoma or pseudoleukæmia (using leukæmia in the sense of lymphocythæmia), Hodgkin's disease. In the more chronic and fibrous varieties of this type the microscopic appearances differ, of course, considerably from those in acute cases.
- (d) Similar to the preceding, but the lymphocyte-like cells invade the blood stream. Lymphatic or splenic lymphocythemia.
 (e) A new-growth in the bone-marrow of cells derived from the
- (e) A new-growth in the bone-marrow of cells derived from the myelocytes not invading the circulating blood. Myelogenic pseudo-leukæmia (using leukæmia in the sense of myelogenic or splenomedul-lary leucocythæmia). To cases of this type and to "mixed cases" partaking of this type the term multiple myeloma (myelomatosis) might perhaps be limited.
- (f) A new-growth characterized by its myelocyte-like cells overflowing or being drawn out into the circulating blood and by Bence-Jones

lymphocytes of the blood, in the bone-marrow gives rise to the myelocytes and thus indirectly to the polymorphonuclear leucocytes also.

albumosuria, not occurring as it sometimes does in the preceding type. Myelogenic or splenomedullary leukæmia (leucocythæmia).

According to this scheme, one must regard the excess of white corpuscles in the blood in all kinds of leukemia as due to an inroad of tumor cells from a hyperplasia-like tumor formation in the leucocyte-producing tissues of the body, all forms of leucocytes (including lymphocytosis) being merely expressions of some reaction in the tissues in question. A leucocytosis is, therefore, strictly speaking, never an early stage of leukemia (leucocythemia); yet a true leucocytosis from any cause may perhaps sometimes be followed by true leukemia in so far as a reactive growth in leucocyte-producing tissues (of which reactive growth the leucocytosis is the expression) may be supposed to give a start to the kind of tumor formation of which leukemia is the expression, just as chronic irritation of the skin sometimes acts as the exciting cause of epithelioma.

The Bence-Jones Proteid in the Urine of Multiple Myeloma Cases.

Drs. Hutchison and Macleod concluded that in the present case the bone-marrow was probably the seat of production of the proteid in question, and that this proteid is not a non-assimilated digestive proteid, as suggested by Magnus-Levy.² As confirming their views, I found that a considerable alteration of diet maintained during two days had no effect in altering the quantity of proteid excreted in the nrine. Moreover, Dr. Bradshaw in his case found that meals had little or no influence on the excretion of the proteid in the urine. He found that as much was excreted by night as by day,³ when the patient was taking meals during the daytime only; and he considered the rate of excretion to be "pretty constant throughout the twenty-four hours."

It seems that when it is free in the blood the Bence-Jones proteid appears in the urine, as hæmoglobin does whenever owing to various causes sudden unusual hæmolysis occurs. The fact, therefore, that the quantity excreted in the urine is little influenced by meals and by change of diet speaks strongly against the correctness of Magnus-Levy's views. It is possible that the cells of the new-growth in the bone may produce digestive enzymes, by the action of which on the albuminous constituents of the blood serum the Bence-Jones proteid is steadily and continually manufactured; then from the circulating blood it would pass through the renal filter with the urine, like hæmo-

¹ Pappenheim's various writings, loc. cit., etc. ² Loc. cit.

³ See the tables at the end of Dr. Bradshaw's first paper. Med.-Chir. Trans., 1898, vol. lxxxi. pp. 270, 271.

⁴ Sir Lauder Brunton has kindly directed my attention to certain experiments of B. J. Stokvis, published in the Maandblad der Sectie voor Natuurwetenschappen, 1872, No. 6. The latter found that Bence-Jones proteid, when a not very concentrated solution was injected into the rectum of a dog, was excreted unchanged in the urine.

globin, even in the absence of any kidney disease. As already mentioned, there may be some connection between the excretion of the proteid in the urine and the formation of granules and globules in the cells of the new-growth in the present case.

Diagnosis of Multiple Myeloma (Myelomatosis), with and without Bence-Jones Proteid in the Urine.

There is still much uncertainty as to the nature of multiple myeloma (multiples myelom), a term first employed by J. von Rustizky, who regarded the growth as formed by a simple hypertrophy of bonemarrow. As already mentioned, however, the tumors from different cases do not all resemble each other in their histological features, though they possess certain characters in common. The growth is generally so diffuse in its distribution that it is impossible to determine that any one part represents a primary focus where the neoplasm may be supposed to have commenced. It does not invade other tissues by metastasis through the blood channels as sarcoma does, though in some cases the lymphatic glands have been involved (cf. Case 3 in the Summary at the end).

Owing to the softening and fragility of bones, the pains and the progressive kyphosis caused by the disease, the diagnosis is from:

- (a) Osteomalacia.
- (b) Muscular rheumatism, lumbago, sciatica, etc.
- (c) Spondylitis deformans.
- (d) Caries of the spinal column.
- (e) Invasion of the vertebral column and other bones by secondary malignant tumors. Owing to the progressive anæmia and cachexia, one may think of:
- (f) Pernicious anamia or other diseases associated with progressive cachexia. Owing to the possibility of confusing Bence-Jones proteid in the urine with albumin, the cases of multiple myeloma in which this body is present in the urine (i. e., the cases of "myelopathic albumosuria" of Bradshaw, "Kahler's disease") may be at first mistaken for:
 - (g) Nephritis.
- (a) Osteomalacia. From the typical osteomalacia of women multiple myeloma differs in the following respects. The former attacks women during the childbearing period of life. It affects chiefly the bones of the pelvis and lower extremities. It gives rise to great deformity by the bending of the bones, but more rarely to "spontaneous" fractures. Multiple myeloma attacks men as often as women, or more often, and chiefly those in the second half of life. Clinically, it appears specially to affect the vertebral column, ribs, and sternum, though the bones

Multiples Myelom. Deutsche Zeitschrift f. Chirurgic, Leipzig, 1873, vol. iii. p. 162.
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of the extremities have certainly been involved in some cases, as they were in my present case. It is likely to cause fractures of the ribs and deformity by bending of the vertebral column and sternum; in one case (Case No. 20 in the Summary) "spontaneous" fracture of one femur occurred, and in another (Case No. 24 in the Summary) "spontaneous" fractures of both femora are recorded; yet it does not give rise to the characteristic deformities of osteomalacia resulting from yielding of the pelvis and bending of the bones of the lower extremities. It is possible, however, that there may be true cases of osteomalacia in males and in elderly females in which the bones of the vertebral column and trunk are specially affected.

- (b) Muscular Rheumatism, Lumbago, Sciatica, etc. Several cases of multiple myeloma have, at least during part of the disease, been given such headings. The occurrence of markedly bilateral thoracic, abdominal, or lumbago-like pains may first direct attention to the possibility of disease of the spinal column. In my first case of multiple myeloma, pain on both sides of the abdomen, together with the presence of an increasing kyphosis, pointed to grave disease of the spinal vertebræ. Sometimes examination of the bones by Röntgen rays may prove of service (vide Case No. 13 in the Summary at the end). If grave rheumatoid or rheumatic arthritis is a complication, as in my present case, it obviously becomes difficult to distinguish pains and paræsthesiæ due to the arthritis from those due to the multiple myeloma.
- (c) Spondylitis Deformans. This affection of the vertebral column may produce a similar kyphosis to that which in several cases has been caused by multiple myeloma. When, however, the kyphosis is due to spondylitis deformans, the spinal rigidity in the cervical region is probably more pronounced than in cases of multiple myeloma, while the patient is likely to be less anæmic and cachectic.
- (d) Caries of the Spinal Column. The progressive bending of the vertebral column seen in multiple myeloma might be confused with tuberculous caries, that is, with those rather rare cases occurring in middle or old age and giving rise to progressive curvature. On the other hand, the curvature due to myeloma is somewhat less likely to be distinctly "angular" than that due to tuberculosis, and in the latter disease the ribs are not likely to be in any way affected simultaneously

¹ Trans. Path. Soc., loc. cit.

² Cases in which the vertebral column only is affected (von Bechterew's type) may be distinguished from those in which the extremities, especially the hip-joints, are likewise affected (Strümpell's type, Pierre Marie's "spondylose rhizomélique"). Such cases of chronic ossifying arthritis may progress to universal bony ankylosis. (See the summary of cases by Dr. Joseph Griffiths in the Journal of Pathology and Bacteriology, December, 1896, and March and June, 1897. Much has been written on the subject during recent years in France and Germany.) Of course, when ankylosis of the joints of the extremities has occurred, a case could hardly be mistaken for one of multiple myeloma, but even at the commencement of the disease such a mistake is very unlikely to be made.

with the spinal column. The sternum has sometimes become excessively bent in multiple myeloma. The presence of tuberculosis in the lungs might help to clear up the diagnosis.

- (e) Invasion of the Vertebral Column and Other Bones by Secondary Malignant Tumors. Secondary localized malignant tumors may give rise to a progressive curvature of the vertebral column. The vertebral column and ribs may likewise be diffusely infiltrated by metastatic carcinoma, but all such metastatic growths are more likely to cause distinct swellings or give rise to local signs of their presence. Evidence as to a primary malignant growth existing or having been removed from some other part of the body would facilitate the diagnosis, and in localized tumors, as well as in tuberculous caries, help might be obtainable from the Röntgen rays.
- (f) Pernicious Anæmia, etc. Anæmia and progressive wasting and feebleness may be marked features of myelomatosis, at all events in the later stages, when the blood-forming functions of the bone-marrow are greatly impaired by the diffuse tumor formation. The pains and other signs of bone disease, such as progressive kyphosis, when these are well marked, will help to distinguish cases of multiple myeloma from pernicious anæmia and forms of progressive cachexia dependent on visceral cancer, etc.
- (g) Nephritis. The Bence-Jones proteid when present in the urine may be confused with albumin, and the case may be regarded as one of nephritis. This is especially likely to occur if the urine on the first occasion is examined very hurriedly (for example, by heating it without boiling it, or by merely adding pieric acid or nitric acid in the cold), and, owing to the copious precipitate of supposed ordinary albumin, it is subsequently examined every day by Esbach's tube. This actually occurred in the present case, where the general "puffy" look of the patient seemed to correspond to the finding of albuminuria. Moreover, in this case, as in some other cases, hyaline casts were found in the urine. Afterward the testing of the urine by the ordinary methods, instead of by Esbach's solution, led to the detection of the special proteid it contained.

I need not repeat what has already been said in regard to the tests

¹ In some cases, however, of multiple myeloma, with or without Benee-Jones proteid in the urlne, localized tumors connected with the bones could be seen or felt during life. (See Cases 14, 19, 27, and 33 in the Summary at the end.)

² The remarkable constancy in the amount and the large quantity of the proteid in the urine ought perhaps to have eaused some surprise.

³ The necropsy, it should be remembered, showed the presence of actual interstitial fibrotic changes in the kidneys. In Senator's case (Case No. 7 in the Summary) easts and albumin were present in the urine, and the kidneys were found to be somewhat diseased at the postmortem examination. In d'Alloceo's ease (No. 15) there was likewise nephritis; in Eilinger's (No. 9) the urine contained a few hyaline casts; and in Conti's (No. 27) during the last weeks of life the urine contained albumin and hyaline and granular casts.

to be employed for distinguishing Bence-Jones proteid in the urine from albumin and from certain albumoses. In the albumosuria occasionally met with in cases of intestinal ulceration and febrile disorders the quantity of proteid in the urine is generally far less than in Bence-Jones albumosuria. In such a case as that recorded by Dr. R. Hutchison, where the proteid, though precipitated at as low a temperature as 58° C., was not, even partially, redissolved on heating to the boiling point, the chances of wrongly regarding the precipitate as one of ordinary urinary albumin must be still greater than they were in the present case, where the greater part of the precipitate redissolved on boiling the urine.

I now come to the diagnostic value of finding Bence-Jones proteid in the urine. From a study of cases the following conclusions must be arrived at: 1. Undoubtedly a considerable number of cases of multiple myeloma have occurred in which the Bence-Jones proteid has not been detected. In some of them the urine may have been examined at a stage of the disease prior to the commencement of the "Bence-Jones albumosuria." In other cases the urine may possibly have been insufficiently examined. Still there remain sufficient cases to enable one to affirm with almost absolute certainty that "multiple myeloma" may occur without giving rise to the presence of Bence-Jones proteid in the urine. It must be remembered, however, that different types of tumor have been included under the heading "multiple myeloma," but I will not repeat here the conclusions which I have already mentioued in an earlier part of the present paper. 2. Metastatic tumors affecting the skeleton, however extensively the bonemarrow be infiltrated, have never yet been known to cause "Bence-Jones albumosuria." 3. The presence of Bence-Jones proteid in the urine is practically invariably of fatal significance, and nearly always, if not always, indicates that the patient is suffering from "multiple myeloma." 4. One or two published cases in which Bence-Jones proteid was present in the urine seem, however, to have been exceptions to the rule in that they were supposed not to be instances of multiple Moreover, the experiments of Dr. G. Zuelzer, should they be confirmed, would make the existence of such exceptions more prob-

¹ I do not think that Dr. L. N. Boston's caustic soda and lead acetate test (A Rapid Reaction for Bence-Jones Albumose, The American Journal of the Medical Sciences, October, 1902, p. 567) is likely to be of much service in this connection.

² Case No. 30 in the Summary of Cases at the end.

³ In the case of Stokvis and Kühne (Case No 2 in the Summary) the Bence-Jones proteid is said to have appeared late in the disease, and could not be found three months before the patient's death. Conti says that during the last weeks of life in his case (No. 27 in the Summary) the urine contained albumin, but no Bence-Jones proteid.

⁴ Ueber experimentelle Beuce-Jones'sche Albumosurie. Berliner klinische Wochenschrift, 1900, No. 40, p. 894. See also Campbell-Horsfall's account of temporary Bence-Jones albumosuria in a patient after severe injury to a leg. Lancet, London, April 25, 1903.

able. He rendered a dog anæmic by giving it pyrodin by the mouth. On the eighth day from the commencement of the experiment a substance was detected in the urine giving the typical reactions for Bence-Jones proteid, and no albumin was present. The pure Bence-Jones albumosuria lasted four days, and then albuminuria occurred and the amount of the Bence-Jones proteid diminished. It would be interesting to know what changes occurred in the bone-marrow of this animal.

Taking all the data that I can obtain into consideration, it seems to me quite possible: 1. That Bence-Jones albumosuria is always the result of disease of the bone-marrow. 2. That it is due to an abnormal metabolic or degenerative process in the myelocytes or in tumor cells derived from the myelocytes or their predecessors. 3. That the reason why it is generally, though not always, associated with myelogenic tumor formation is that the tumor cells derived from bone-marrow cells, however much they may morphologically resemble true bone-marrow cells, are more prone to abnormality (including unusual degenerative changes) than real myelocytes are. 4. That non-myelogenic tumor cells are not affected in the same way, and therefore metastatic tumors in the bone-marrow do not give rise to Bence-Jones albumosuria.

I shall now give references to all the reported cases in which Bence-Jones proteid has been detected in the urine, whether the presence of bone disease was verified or not. I shall also refer to some doubtful cases in which the reactions of the proteid in the urine were not quite characteristic for Bence-Jones proteid, and shall mention certain supposed cases obviously incorrectly included in previous summaries on the subject. For full details, the original papers, to which references are given under each case, must be consulted, but for short abstracts of the earlier cases Dr. C. E. Simon's paper in The American Journal of the Medical Sciences for June, 1902, may be consulted. Among doubtful cases are those, such as that reported by R. Hutchison (Case No. 30), in which, though a copious precipitate occurs on slightly heating the urine, yet this precipitate is not to any extent dissolved by further heating. In this connection it must be remembered that the

¹ An analogy between Benee-Jones aibumosuria and melanuria may be made. The presence of meianin and meianogen in the urine is best known in cases of meianotic tumor, but has been noted likewise in wasting diseases. Melanotic tumors, however, are not always associated with the exerction of melaniu or meianogen in the urine; yet, as Dr. A. E. Garrod points out (St. Bartholomew's Hospital Reports, vol. xxxviii. p. 25), melanuria has been undervalued for diagnostic purposes because other conditions in which the urine blackens on exposure to air have been confounded with true melanuria.

² I shall not here refer to the eases of "muitiple myeloma without albumosuria," several of which are quoted in my paper in vol. xlviii, of the Transactions of the Pathological Society of London (loc. eit.). On the whole subject of muitiple myeloma, the important writings of F. W. Zahn, Deut. Zeitschr. f. Chirurgie, 1885, vol. xxii. p. 1; Hammer, Virehow's Archiv, vol. exxxvii. p. 280; Markwaid, ibid., vol. exli. p. 123; R. Paltauf, Ergebnisse der allg. Pathologic, edited by Lubarseh and Ostertag, 1896, vol. i. pp. 676-679; K. Winkler, Virehow's Archiv, vol. cixi. p. 252; E. Wieiand, ibid., vol. eixvi. p. 103; and M. Borst, Die Lehre von den Geschwülsten, 1902, vol. i. pp. 492-494, may be consulted.

experiments of Hammarsten, 1 K. Spiro, 2 Magnus-Levy, 3 and others in regard to various proteids show that the point of heat coagulation varies with the dilution and composition of the fluid, and the resolution of the coagulum depends likewise, to a great extent, on the composition of the fluid in which it is suspended. Among cases which should not be included in the Summary are those of albumosuria (other than "Bence-Jones albumosuria") in which no precipitate occurs on merely heating the urine (presumably acid in reaction), but in which the addition of nitric acid to the cold urine gives rise to a precipitate, which dissolves on heating and reappears on cooling.

Summary of Cases of Bence-Jones Albumosuria.

No. 1. The Case of Watson, Macintyre, and Bence-Jones, of London. (H. Bence - Jones, "On a New Substance Occurring in the Urine of a Patient with Mollities Ossium," Phil. Trans. Royal Society of London, 1848, part i., p. 55. W. Macintyre, "Case of Mollities and Fragilitas Ossium," Med.-Chir. Trans., London, 1850, vol. xxxiii., p. 211. J. Dalrymple, "On the Microscopic Character of Mollities Ossium," Dublin Quarterly Jour. Med. Sci., vol. ii., p. 85, 1846.)

No. 2. The Case of Doornik, Stokvis, and Kühne. (W. Kühne, "Ueber Hemialbumose im Harne," Zeitschrift f. Biologie, 1883, vol.

xix., p. 209.)
No. 3. The Case of Kahler and Huppert. (O. Kahler, "Zur Symptomatologie des Multiplen Myeloms: Beobachtung von Albumosurie," Prager medicini-che Wochenschrift, 1889, vol. xiv., p. 33. H. Huppert, "Ein Fall von Albumosurie," ibid., p. 35.)
No. 4. The Case of Stokvis, Ribbink, and Zeehuisen. (B. J. Stokvis,

Nederl. Tijdschrift voor Geneesk., 1891, vol. ii., p. 36. H. C. G. Ribbink's Dissertation, Amsterdam, 1892. H. Zeehuisen, Nederl. Tijdschrift voor Geneesk., 1893, vol. i., p. 829. See also abstracts in Maly's Jahresbericht f. Thier. Chem., vol. xxi., p. 412; vol. xxii., p. 525; vol. xxiii., p. 577.)

No. 5. The Case of Raschkes. (A. Raschkes, "Ein Fall von seniler Osteomalacie mit Albumosurie," Prager med. Wochenschrift, December 20, 1894, No. 51, p. 649.)

No. 6. The Case of Professor Stintzing, of Jena. (Seegelken, "Ueber Multiples Myelom und Stoffwechsel Untersuchungen bei derselben," Deut. Archiv f. klin Med., 1897, vol. lviii., p. 276. M. Matthes, "Ueber Eiweisskörper im Urine bei Osteomalacie," Ver-

¹ Loc. cit. 2 Loc. cit. 4 A typical example of this is recorded by Hougounenq, Lyon Médical, January 20, 1901, vol. xcvi. See, also, E. Vidal's case, Comptes rendus de la Société de Biologie, October 29, 1898, p. 991, in a woman, aged twenty-four years, suffering from tuberculous disease of the right shoulder. Dr. J. A. Blair's Case of Albumosuria, British Medical Journal, September 14, 1901, p. 713, is doubtless of the same kind. He states that the urine "gave no perceptible precipitate on simple heating without acid," but that on adding nitric acid to the cold urine a precipitate occurred which was dissolved on heating and reappeared on cooling. This kind of albumosuria is doubtless much less rare than the Bence-Jones albumosuria, and is probably sometimes altogether overlooked owing to the fact that the boiling test for albumin is more often employed than the nitric acid (cold) test. It must be remembered, however, that in true Bence-Jones albumosuria the urine, if alkaline, should likewise not be expected to give any precipitate on heating until it has been rendered slightly acid, e. g., by the addition of acetic acid.

handl. des XIV. Congresses f. innere Medicin, 1896, p. 476. R. Neumeister, Lehrbuch der Physiol. Chemie, 1897, second edition, p. 804.)

No. 7. Senator's Case. (H. Rosin, "Ueber einen eigenartigen Eiweisskörper in Harne und seine diagnostische Bedeutung," Berliner klin. Wochenschrift, 1897, p. 1044. H. Senator, "Asthenische Lähmung, Albumosurie und Multiple Myelome," Berliner klin. Wochenschrift, 1899, p. 161. The urine has likewise been studied in Süssmann's Dissertation, Leipzig, 1897.)

No. 8. Bozzolo's Case. (Camillo Bozzolo, "Sulla Malattia di Kahler," in the Transactions of the Eighth Medical Congress, Naples, October, 1897; and in La Clinica Medica Italiana, Milan, January, 1898, p. 1; referred to also in Centralblatt f. die med. Wissenschaft,

1898, vol. xxxvi., p. 572.)

No. 9. The Case of Lichtheim and Ellinger. (A. Ellinger, "Das Vorkommen des Bence-Jones'schen Körpers im Harn bei Tumoren des Knochenmarks und seine diagnostische Bedeutung," Deut. Archiv f.

klin. Medicin, 1899, vol. lxii., p. 255.)

No. 10. Bradshaw's Case. (T. R. Bradshaw, "A Case of Albumosuria in which the Albumose was Spontaneously Precipitated," Med.-Chir. Trans., London, 1898, vol. lxxxi., p. 259. Bradshaw and Warrington, "The Morbid Anatomy and Pathology of Dr. Bradshaw's Case of Myelopathic Albumosuria," ibid., 1899, vol. lxxxii., p. 251. Bradshaw, Transactions of the Pathological Society, London, 1900, vol. li., p. 140. Bradshaw, "Myelopathic Albumosuria," British Medical Journal, November 3, 1900, p. 1304. Bradshaw, "Myelopathic Albumosuria," Lancet, October 4, 1902, p. 929.)

No. 11. Case of Naunyn and Magnus-Levy. (Naunyn, "Ein Fall von Albumosurie," Deutsche med. Wochenschrift, 1898, Vereins-Beilage, p. 217. A. Magnus-Levy, "Ueber den Bence-Jones'schen Eiweisskörper," Hoppe-Seyler's Zeitschrift f. Phys. Chemie, 1900, vol. xxx., p.

200.)

No. 12. The First Case of Dr. Fitz. (R. H. Fitz, "The Significance of Albumosuria in Medical Practice," The American Journal

OF THE MEDICAL SCIENCES, 1898, vol. exvi., p. 30.)

No. 13. The Second Case of Dr. Fitz. (R. H. Fitz, loc. cit., p. 42. J. H. Wright, "A Case of Multiple Myeloma," Johns Hopkins Hospital Reports, 1900, vol. ix., p. 359; also Journal of the Boston Society

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No. 15. D'Allocco's Case. (D'Allocco, "Sulla Malattia di Kahler," at the Tenth Medical Congress, Rome, October, 1899, Arch. Ital. di Medicina Interna, 1900, vol. iii., fasc. Nos. 1 and 2; referred to also by U. Flora in his article, "Sulla Malattia di Kahler," Rivista Critica di Clinica Medica, Elegence, 1900, Nos. 46, and 47)

di Clinica Medica, Florence, 1900, Nos. 46 and 47.)

No. 16. The Case of Lichtheim and Askanazy. (S. Askanazy, "Ueber die Diagnostische Bedeutung der Ausscheidung des Bence-Jones'schen Körpers durch den Harne," Deutsche Archiv f. klin. Medicin, 1900, vol. lxviii., p. 34.)

No. 17. Latzko and Sternberg's Case. (M. Sternberg, in "Vege-

tationsstörungen und Systemerkrankungen der Knochen," Nothnagel's Spec. Path. u. Therapie, 1899, vol. vii., part ii., division 2, p. 57.)

No. 18. Barr's Case. (J. Barr, "Case of Myelopathic Albumosuria,"

Liverpool Med.-Chir. Journal, March, 1901, p. 23.)
The patient was a man, aged fifty-three years. There were pains in the spinal column, a swelling in the manubrium sterni, etc. The bone disease seemed to be of progressive character. Barr found the quantity of urine usually between forty and sixty ounces daily, and it rarely contained less than twelve per mille of the Bence-Jones proteid. understand that no post-mortem examinaton was made. In connection with my own recent case it is interesting to note that Dr. Barr's patient presented undoubted signs of cardiac valvular disease.

No. 19. The Case of a French Physician. (T. R. Bradshaw, "On the Evolution of Myelopathic Albumosuria," British Medical Journal, July 13, 1901, p. 75. Obituary notice on Dr. P. F. Colrat, British

Medical Journal, September 7, 1901.)

The patient was a well-known French physician of Lyons, aged fifty-five years. The Bence-Jones proteid first appeared in the urine in December, 1899; the amount was at first very little, but it gradually increased and ultimately reached a maximum proportion of ten per mille. Death occurred from pneumonia in August, 1901. In this case Bradshaw (Lancet, October 4, 1902, p. 931) says he observed a semi-fluctuating swelling of about the size of a large hen's egg in connection with one of the ribs.

No. 20. The Case of Iglehart, Hamburger, and Simon. (L. P. Hamburger, "Two Examples of Bence-Jones Albumosuria associated with Multiple Myeloma," Johns Hopkins Hospital Bulletin, February, 1901, p. 38. C. E. Simon, "Observations on the Nature of the Bence-Jones Albumin," THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, June, 1902, p. 939.)

The patient was a lady, aged forty-nine years, whose first symptom was a sharp pain over one of the ribs, in August, 1900. The examination of the urine led to the clinical diagnosis of multiple myeloma. Spontaneous fracture of the left femur occurred a few days before the

patient's death in August, 1901. No necropsy was made.

No. 21. The Case of Osler, Hamburger, and MacCallum. (Hamburger, loc cit. W. G. MacCallum, "A Case of Multiple Myeloma,"

Journal of Experimental Medicine, 1901, vol. vi., p. 53.)

The patient was a colored woman, aged fifty years, admitted to the Johns Hopkins Hospital in October, 1900. The urine contained Bence-Jones proteid, and the clinical diagnosis of multiple myeloma was confirmed by the necropsy findings recorded by MacCallum.

No. 22. Kalischer's Case. (S. Kalischer. "Ein Fall von Ausscheidung des Bence-Jones'schen Eiweisskörper," Deutsche med.

Wochenschrift, 1901, No. 4, p. 54.)

The patient was a woman, aged sixty-seven years. In this case a spontaneous precipitate (supposed to be of the Bence-Jones proteid) was observed in the urine on allowing it to stand for a long time. After death, examination of the ribs showed a tumor-like hyperplasia of the bone-marrow. Professor Löwy failed to detect the presence of Bence-Jones proteid in the bone-marrow from the ribs and humerus. It may be noted that one of the patient's daughters had died, at the age of thirty years, of "pernicious anæmia."

No. 23. Rostoski's Case. (O. Rostoski, "Albumosurie und Peptonurie," at the meeting of the Phys.-Med. Ges. zu Würzburg, June 13, 1901, reported in the Sitzungs-Berichte, 1901, Nos. 2 and 3; abstract

in Münchener med. Wochenschrift, July 2, 1901.)

Rostoski gives no details of this case, but from the results of his examination of the urine says that he inclines to the view of Magnus-Levy that the Bence-Jones proteid (at least, what he found in his case) is not to be classed as an albumose. He has likewise recorded certain investigations regarding the Bence-Jones body in his paper, "Zur Kenntnis der Präcipitine" (Würzburg, 1902). No. 24. The Case of Jochmann and Schumm. (G. Jochmann and

Schumm, "Typische Albumosurie bei echter Osteomalacie," Münchener med. Wochenschrift, August 20, 1901, p. 1340; and "Zur Kenntnis des Myeloms und der Sogenannten Kahler'schen Krankeit."

Zeitschrift f. klin. Medicin, 1902, vol. xlvi., p. 445.)

The patient was a woman, aged thirty-seven years, who was admitted to the Hamburg-Eppendorf Hospital in November, 1900. Her illness commenced with pains in the hips. Afterward she suffered from pains in the loins and sternum, progressive kyphosis, spontaneous fractures of the thigh bones, and increasing debility. She died from pneumonia, one and a half years after the commencement of the illness. During the last weeks of life her urine contained a considerable quantity of Bence-Jones proteid. She likewise had nephritis and hemorrhagic After death an albumose-like body was detected in the blood. Though the authors originally considered that the case was one of genuine osteomalacia, their description of the post-mortem examination gave rise to considerable doubt as to the correctness of their view. Dr. T. R. Bradshaw, in a short communication on the subject (Münchener med. Wochenschrift, February 4, 1902, p. 191), enumerated the main objections to the acceptance of their pathological inferences, and the authors afterward republished the case as one of multiple myeloma. It should be noted that in this case the pelvis and long bones were affected as well as the ribs and vertebral column.

No. 25. Donetti's Case. (E. Donetti, "Sulla Malattia di Kahler," Rivista Critica di Clinica Medica, Florence, 1901, No. 46, p. 789.)

The patient was a man, aged forty-five years, with a painful affection of the bones, especially of the vertebral column and ribs, with anæmia, and with Bence-Jones proteid constantly in his urine. The method of D'Allocco seemed to demonstrate the presence of Bence-Jones proteid in the blood (compare Case No. 15).

No. 26. The Case of Hijmans van den Bergh. (A. Grutterink and C. J. de Graaff, "Ueber die Darstellung einer Krystallinischen Harualbumose," Hoppe-Seyler's Zeitschrift f. Phys. Chemie, 1902, vol. xxxiv., p. 393. A. A. Hijmaus van den Bergh, "Albumosurie," Herinnerungs-Bundel Prof. Rosenstein, 1902.)

The patient, a man-servant, aged thirty-six years, had enjoyed good health until September, 1900, when he was seized with pain on the left side of the chest. Afterward he had pains on the right side of the chest, in the right shoulder, and in the back. He had to give up work, and was admitted into the Rotterdam Hospital in March, 1901. In the hospital great deformity of the thorax occurred from progressive bending of the vertebral column and sternum, and death took place in December, 1901. At the necropsy the bone-marrow of vertebræ, sternum, and ribs was found transformed into a sarcoma-like growth. A femur was examined and found similarly affected, but in a lesser degree. The liver was fatty and the kidneys showed slight interstitial changes. Miss Grutterink and Miss de Graaff succeeded in obtaining the Bence-Jones proteid in a crystalline form from the urine of this case. I have to thank Dr. Bradshaw for kindly placing Dr. Hijmans van den Bergh's publication at my disposal.

No. 27. Conti's Case. (Pietro Conti, "Albumosuria e Neoplasie Sistematiche delle Ossa," La Clinica Medica Italiana, Milan, 1902,

pp. 211-247.)

The patient was a lady, aged sixty years, whose first symptoms were costal pains in August, 1899, when she was at the health resort of Mont-Dore on account of bronchial catarrh. She died October 30, 1901, after about tweny-six months of suffering. The symptoms of the skeletal disease were chiefly referable to the bones of the trunk—pains connected with the ribs, sternum, and spinal column; kyphosis; and little tumors on the sternum and right ilium. There was cachexia, and toward the end the muscular weakness was extreme. Bence-Jones proteid was first detected in the urine in November, 1900. For several weeks prior to the death of the patient the urine is said to have contained albumin, but no longer any Bence-Jones proteid; it likewise contained hyaline and a few granular casts. Unfortunately, no postmortem examination was made. I am indebted to Dr. A. E. Garrod for drawing my attention to Conti's publication.

No. 28. The Present Case. (Abstract already given.)

Uncertain Cases and Cases in which the Reactions of the Proteid in the Urine were not Quite Characteristic.

No. 29. Dr. Sidney Martin (discussion on Dr. Bradshaw's paper, Proceedings of the Royal Medical and Chirurgical Society, 1898, third series, vol. x., p. 120) referred to the case of a woman under the care of Dr. H. R. Spencer, at University College Hospital, for an ovarian tumor, which was removed. The urine, sometimes milky from precipitation of the proteid, was examined by Dr. Sidney Martin, who states that it contained "the same body or bodies" as those referred to by Dr. Bradshaw in his case. The subsequent history of the case is not given.

No. 30. Dr. R. Hutchison (discussion on the "Proteids in Urine," Transactions of the Pathological Society, London, 1900, vol. li., p. 146) referred to a man who died in the London Hospital with multiple tumors of bones (extremities, ribs, and vertebræ). A flocculent precipitate separated out from the urine at 58° C., but did not redissolve on boiling. In this respect and in its behavior to nitric acid the substance present in the urine had not quite the characteristic reactions of Bence-Jones proteid. The case should certainly, however, be men-

¹ Recently Dr. J. M. Anders and Dr. L. N. Boston, Lancet, London, January 10, 1903, have described three cases of Bence-Jones albumosuria, and Dr. Boston has given notes of a fourth, The American Journal of the Medical Sciences, April, 1903. Vignard and Gallavardin, Revue de Chirurgie, Paris, 1903, No. 1, have recorded two doubtful cases. Campbell-Horsfall, Lancet, London, April 25, 1903, has apparently observed temporary genuine Bence-Jones albumosuria after a severe injury to the leg. J. A. Milroy's case, Journal of Pathology, Edinburgh, vol vil. p. 95, of multiple myeloma with albumosuria has been unfortunately omitted in making up my list.

tioned here. Dr. Hutchison kindly informs me that the patient was thirty-eight years old, and died within a week of admission. The upper end of one humerus, preserved in the London Hospital Museum, is much enlarged by a very vascular growth. Sections from one of the growths show it to consist chiefly of rather large, rounded, or polygonal cells, with a good deal of protoplasm around a medium-sized nucleus. The protoplasm of many of the cells, Dr. Hutchison tells me, contained granules, possibly of the same nature as those in the cells of the growth in my case.

No. 31. Dr. Lee Dickinson (discussion on the "Proteids in Urine," Transactions of the Pathological Society, London, 1900, vol. li., p. 170) mentioned a case of leucocythemia in the practice of Mr. Edgecombe Venning in which Bence-Jones proteid—or, at all events, a proteid coagulating like Bence-Jones proteid at a relatively low temperature—occurred in the urine, and in which no other disease but leucocythemia

could be found.

Supposed Cases which have been Incorrectly Included in Summaries of Bence-Jones Albumosuria Cases.

No. 32. A case described by Byrom-Bramwell and Nöel-Paton ("On a Crystalline Globulin occurring in Human Urine," Reports from the Laboratory of the Royal College of Physicians, Edinburgh, 1892, vol. iv., p. 47) was at one time regarded by Huppert ("Ueber einen Fall von Albumosurie," Hoppe-Seyler's Zeitschrift f. Phys. Chemie, vol. xxiii., p. 500) as an instance. But after himself examining the proteid from the urine in question he altered his mind (Ueber den Nöel-Paton'schen Eiweisskörper," Centralblatt f. die med. Wiss., July 9. 1898, p. 481) and regarded the substance as a globulin. The case is remarkable for the spontaneous precipitation of the proteid in crystalline form on allowing the urine to stand for a longer or shorter period, sometimes a day or two, sometimes weeks or months.

No. 33. Simon (THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, June, 1902, p. 954) wrongly cites a case reported by Karl Ewald ("Ein Chirurgisch Interessanter Fall von Myelon," Wiener klin. Wochenschrift, 1897, p. 169). The patient was a man, aged sixtytwo years. The diagnosis of myeloma was made during life owing to the examination of part of a growth removed from the right clavicle in April, 1894. Death occurred in May of the same year. No necropsy is recorded, and Bence-Jones proteid is not said to have been found in the urine. The case, therefore, cannot be accepted as an example of multiple myeloma with Bence-Jones albumosuria, although Jochmann and Schumm (Zeitschrift f. klin. Med., 1902, vol. xlvi., p. 467), as well as Simon, have referred to it as such.

No. 34. A supposed case of Dr. Vladimir de Holstein (Semaine Médicale, 1898, p. 206, and 1899, p. 83) is likewise referred to by Simon, loc. cit., p. 955), who states that the diagnosis of "multiple myelomatosis" was made during life, owing to the state of the urine, and that the diagnosis was confirmed by a subsequent necropsy. However, on looking up Simon's references, I could only find a notice of Bradshaw's case, and a short résumé of the subject by Dr. V. de Holstein, but no

new case.

A CONVENIENT MODIFICATION OF TESTS FOR HYDRO-CHLORIC ACID IN GASTRIC CONTENTS.

BY CHARLES SUMNER FISCHER, M.D., of New York CITY.

The modification consists of a simple process of combining three well-known methods in such a manner as to make it possible to estimate both free and combined hydrochloric acid in the smallest possible quantity of gastric contents and within a space of time calculated to make this practical for clinical use. The three methods referred to are those of Töpfer for free hydrochloric acid, of Honigman and v. Noorden for hydrochloric acid deficiency, and the more recent method of Cohnheim and Krieger for the determination of combined hydrochloric acid, which method has not received the clinical attention which it deserves. The desirableness of possessing some more rapid and fairly accurate method for the determination of the combined hydrochloric acid in the clinic must be evident to everyone whose attention has been given to this subject, for the most accurate methods which we possess, namely, those of incineration, require the experience and laboratory surroundings of the trained chemist for their proper operation, and even then their accuracy is a subject for discussion in some cases.

Of these methods, those of Sjoqvist, Leo, Hehner-Seeman, and Martius and Lüttke have survived the test of time, but of them all the last one is probably the only one which can be adapted to practical use by the clinician. Even this method has been subjected to criticism by Rosenheim and requires a certain chemical skill in incinerating to determine the proper moment when the process is completed, a skill which it is not always possible for the physician to acquire.

Of any of the methods proposed for the determination of the combined hydrochloric acid, that with alizarin, as advocated by Töpfer, is probably the most popular. In this method, practical as it is, the end-reaction is often so gradual and indefinite that the results obtained, except for those of great experience, are valueless in most cases. The well-defined play of colors from yellow to red-violet and pure violet, obtained with solutions of acids, disodiumphosphate, and sodium carbonate become ill-defined in fluids containing proteids in any form, as they may be present in the contents of the stomach. A trial with a 1 per cent. neutral solution of egg albumin to which has been added a known quantity of one-tenth normal hydrochloric acid solution (albumin solution 5 c.c., 0.5 HCl solution 2 c.c.) will convince one of this. The quantity of combined hydrochloric acid in such a mixture would correspond to 0.8 c.c. of the normal solution, thus leaving 1.4 c.c. as

free hydrochloric acid. Titrating such a combination with alizarin, the pure violet tint does not appear until the point at which all the free hydrochloric acid has been neutralized has been decidedly exceeded, while the change itself from yellow to violet is most gradual. In gastric contents these inconveniences are markedly increased, due probably to the more complex composition of the same, to the diversity of original color which they possess, or to opacity and cloudiness which result from particles in suspension that cannot be removed by ordinary filtration.

In this connection I would like to call attention to the method elaborated by Cohnheim and Krieger for the determination of the combined hydrochloric acid in gastric contents, for, while not absolutely accurate from a chemical standpoint, it yields results which surpass in exactness any of our possible clinical methods, especially as its short-comings are known, and any necessary corrections can be made in the results. The method itself is not so well known but that a short description might be in place. Its action depends primarily upon the precipitation of all proteids in solution by phosphotungstic acid. For this purpose Cohnheim and Krieger employed a 4 per cent. solution of calcium-phosphotungstate. Such a solution added in excess to a solution of proteids containing hydrochloric acid in excess will precipitate all the proteids as proteid-phosphotungstate, whereas the hydrochloric acid previously combined with the proteids will enter into solution as neutral calcium chloride. In gastric filtrates which do not contain free hydrochloric acid in excess a certain known quantity of 0.5 normal hydrochloric acid solution should be added and this taken into account in the final calculation. Hence, given the total acidity of the gastric filtrate with phenolphthalein and the total acidity obtained after precipitation with the calcium phosphotungstate solution, we would have a difference which should represent the combined hydrochloric acid.

In a comparison of the results obtained by their method with those obtained by that of Sjoqvist, Cohnheim and Krieger report errors ranging from 5 to 10 degrees. I am convinced that these can be reduced materially by slight modification of method. One source of error lies in the difficulty of securing the whole excess of acid in the filtrate after precipitation of the proteids. For this purpose repeated washing of the residue would be necessary, which in turn would increase the volume of the filtrate to such proportions as to render all color reactions unreliable. Another source of error lies in the fact that in most subacid gastric contents certain proteid products are in solution in excess of the hydrochloric acid present. These products combine with the hydrochloric acid added in excess to secure complete precipitation with the calcium phosphotungstate and help to swell the preexisting combined hydrochloric acid. In order to eliminate the first source of error it has been my custom to avoid washing off the pre-

cipitated proteids by employing only one-half of the known total filtrate and multiplying the result by 2, the customary procedure in the estimation of the total chlorides by the method of Martius and Lüttke. The second source of error, which is confined to gastric contents containing no free hydrochloric acid, can be corrected by first determining the hydrochloric acid deficiency in the gastric contents according to the idea suggested by Honigman and subtracting this deficiency from the quantity of combined hydrochloric acid found. The details of this second modification I shall describe later.

In a long series of comparative analyses of hyperacid, subacid, and anacid solutions, both natural and artificial, by this method and that of Martius and Lüttke, I have found that the error could be reduced to 4 degrees if the suggested modifications were employed, and that the error was usually upon the side of excess rather than deficiency. In many instances the results were alike. As the method of Martius and Lüttke is not faultless, it was difficult in some instances to decide to which to ascribe the difference in the results obtained; but as an error of 4 degrees cannot vitiate the value of either method from a clinical standpoint, it would hardly be necessary to discuss it further.

In order to make it possible to rapidly estimate the combined and free hydrochloric acid in the same 5 c.c. of gastric contents I have combined and modified these three given methods. The solutions necessary for this are the usual 0.1 normal sodium hydrate solution, 0.1 normal hydrochloric acid solution, and the 4 per cent. neutral solution of calcium phosphotungstate. The latter is easily prepared by dissolving 4 grammes of phosphotungstic acid in 100 cubic centimetres of distilled water by boiling and then neutralizing the boiling solution with an excess of calcium carbonate. The boiling should be continued for a few minutes to drive off the carbon dioxide, after which the solution can be filtered into a vessel graduated at 100 c.c., and whatever fluid has escaped by evaporation can be replaced. These three solutions are stable, and can be kept in burettes ready for use.

The operation itself would be the following: 5 c.c. of filtered gastric contents are measured into a small dry beaker and the free hydrochloric acid estimated with dimethylamidoazobenzol. In doing this it would be wise to follow the advice of Hari not to carry the titration beyond the deep orange tint. The total acidity is next determined by adding phenolphthalein to the mixture and titrating to the limit of reaction. The results obtained being noted, a quantity of 0.1 normal hydrochloric acid solution, corresponding to the quantity of sodium hydrate solution already employed, is added to obtain the original total acidity of the gastric contents. The total number of cubic centimetres of the mixture being known (gastric contents + 0.5 NaOH + 0.5 HCl), the calcium-phosphotungstate solution is added in sufficient

quantity to bring the whole up to 30 c.c. (15 to 20 c.c. usually are necessary). The mixture is thoroughly agitated and allowed to stand three to four minutes. In order to decolorize the same a small quantity of chemically pure animal charcoal is thoroughly stirred into it and the whole filtered through a dry filter into a dry beaker. The animal charcoal not only retains all the color, but also holds back the phenolphthalein, which substance would otherwise render the following titration uncertain. The filtrate is colorless and very rapidly obtained.

Of this filtrate 15 c.c. are measured into a dry beaker and the total acidity determined with the sodium hydrate solution. The result doubled would give the new total acidity of the whole mixture. As phenolphthalein does not give a clear end-reaction in the presence of calcium-phosphotungstate, Cohenheim and Krieger employed for this titration a 1 per cent. alcoholic solution of rosolic acid. Six drops of this added to the 15 c.c. employed will give a yellow clear fluid which turns to red when the acid is neutralized. The titration should be carried out rapidly and to an end-reaction over a white underlying surface. If any uncertainty as to the end-reaction exists it is safer to add a few drops more of the sodium hydrate solution as any error will be largely in favor of finding the total acidity too low. The difference between this last total acidity and that obtained originally with phenolphthalein will represent the quantity of combined hydrochloric acid in the 5 c.c. of gastric contents employed.

The successive steps in the operation, which requires no more than ten minutes, would be the following:

- 1. Determine the free HCl with dimethylamidoazobenzol.
- 2. Determine the total acidity with phenolphthalein.
- 3. Add 0.5 HCl solution in quantity equal to 0.5 NaOH employed.
- 4. Add sufficient calcium phosphate to make 30 c.c.
- 5. Allow to stand three to four minutes, add animal charcoal, and filter.
 - 6. Determine the total acidity with rosolic acid.

EXAMPLE.

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Employed gastric contents . . . 5 c.c.

" 0.5 NaOH . . . 4 " (free HCl = 20, total acid 80).

" 0.5 HCl . . . . 4 " (total acid 80).

" Na<sub>2</sub>WSO<sub>4</sub> . . . . 21 "

Total number c.c. . . . 30 c.c. (total acid) 45

Combined HCl = (80-45) . . . 35 "
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In order to secure correct results it is essential that hydrochloric acid should be present in considerable excess, hence the method as given can only be employed where such is the case. In gastric contents which are subacid a slight modification is necessary to secure complete precipitation of the proteids. This can be accomplished by the addition

of an excess of 0.5 normal hydrochloric acid, but in so doing it would be necessary to estimate the hydrochloric acid deficiency according to the idea suggested by Honigman, for any proteid substances in solution not combined with hydrochloric acid would immediately combine with the supplied acid and be added to the real quantity of combined hydrochloric acid originally present. For example, if to a known solution of egg albumin only one-half the quantity of hydrochloric acid necessarv to combine with all the albumin present is added, and the operation of titration carried on as given above, the final result will represent the quantity of hydrochloric acid which would combine with the whole of the albumin present. It can readily be seen that the same would take place in subacid gastric contents capable of combining with hydrochloric acid without yielding equivalent acid returns. In order to correct the error the hydrochloric acid deficiency should be subtracted from the quantity of combined hydrochloric acid found in the final calculation.

The modified operation would be the following:

- 1. Determine the hydrochloric acid deficiency with dimethylamidoazobenzol by adding 0.5 normal hydrochloric acid, and note the quantity employed.
- 2. Determine the total acidity of this mixture with phenolphthalein and 0.5 normal sodium hydrate. This total acidity minus the quantity of hydrochloric acid added would give the original total acidity of the 5 c.c. of gastric contents employed.
- 3. Add 0.5 normal hydrochloric acid in excess. Sufficient should be added to make the new total acidity at least 40 degrees higher than the original total.
- 4. Having noted the total number of cubic centimetres in the mixture, add sufficient calcium phosphotungstate solution to make 30 cubic centimetres and proceed as in the original method. The difference between the total acidity obtained by hydrochloric acid in excess and the final total acidity will represent the quantity of hydrochloric acid combined with all the albumin in the 5 c.c. of gastric contents calculated in degrees. This combined hydrochloric acid minus the hydrochloric acid deficiency will represent the quantity of hydrochloric acid originally combined with proteid in the specimen examined.

EXAMPLE.

Employed subacid gastric contents HCl deficiency (dimethylamldoazobenzo Total acidity (phenolphthalein)	ol) .	•	. 5 c.c. . 1 "	= 20 = 60
Original total acidity			(60-20) "	= 40
Added HCl in excess	•		. 3 "	== 60
Total acidity (rosolic acid) of Total possible combined HCl Actual combined HCl in gastric content				= 30 = 30 = 10

In order to secure good results it is necessary that all measurements should be made with great accuracy and that all vessels and pipettes should be perfectly dry. The animal charcoal should be chemically pure and should be tested before using. It is especially important not to carry the titration with dimethylamidoazobenzol beyond the deep orange tint, whereas those with phenolphthalein and rosolic acid should be carried to the full limit. Operating in this way the error can be reduced to 4 degrees, usually as excess of combined hydrochloric acid, and the necessary allowance can be made. As 4 degrees represent a quantity of hydrochloric acid equal to 0.146 per 1000, it is evident that the method is sufficiently exact for most purposes, and requires but little more time than the determination of the free hydrochloric acid and total acidity as usually practised in offices and clinics.

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TWO CASES OF RELATIVE AORTIC INSUFFIENCY.

BY W. F. HAMILTON, M.D.,

ASSISTANT PHYSICIAN ROYAL VICTORIA HOSPITAL, AND LECTURER IN MEDICINE, M'GILL UNIVERSITY, MONTREAL;

AND

J. R. Byers, M.D.,

RESIDENT PHYSICIAN ROYAL VICTORIA HOSPITAL, MONTREAL.

Relative aortic insufficiency, by which is meant an incompetency of the semilunar valves without an organic lesion of the valves, is so rare that no excuse is needed for recording two such cases which occurred in the Medical Department of the Royal Victoria Hospital.

Edwards, in 1895, stated that a ortic is the rarest of all relative insufficiencies, and that the combined literature of England, France, and Germany did not record more than about twenty-five cases, while some of these were reported twice, though dearth of detail precluded their detection. In the modern text-books there can be found but scaut if any reference to the condition.

Case I.—J. H., aged fifty-nine years, paper cutter, was admitted December 15, 1902. About three weeks before admission he com-

¹ The American Journal of the Medical Sciences, vol. cx. p. 489.

plained of cough, dyspnæa on exertion, palpitation, and ædema of the lower extremities, and, according to his statement, an attack of sudden dizziness was followed by paralysis and inability to speak or move his extremities for some hours. Alcoholism and syphilis were denied.

The examination of the patient on admission gave evidence of disease of the circulatory system—dyspnæa, cyanosis, and ædema being present. The pulse was irregular in volume and rhythm and of high teusion. There was general arteriosclerosis. The heart was enlarged to the left and right, with a diffuse impulse in the fourth, fifth, and sixth intercostal spaces, one inch outside the left nipple line. At the apex the first and second sounds were not clear. Over the aortic area a systolic murmur was audible and transmitted up the vessels of the neck, while at the same area a diastolic murmur, with transmission down the left border of the sternum, was also heard.

Seven days after admission to the hospital the patient became much weaker. There was orthopnea, profuse bloody expectoration, and cardiac irregularity. The diastolic murmur was still present over the aortic region. The lungs gave evidence of edema, and after several hours of distress, marked by the above symptoms, the patient died.

A diagnosis of myocarditis, aortic endocarditis, with regurgitation, mitral endocarditis, with regurgitation, and acute pulmonary ædema

was made.

An autopsy revealed the following conditions with respect to the circulatory system: Hypertrophy and dilatation of the heart; arteriosclerosis; relative insufficiency of the mitral valve and aortic insuf-

ficiency, apparently secondary to atheroma of the arch.

The aortic valve cusps were unaffected by sclerosis, while the arch and whole of the aorta presented signs of arteriosclerosis in extensive calcification and ulceration. The first part of the arch was markedly dilated, and the insufficiency of the aortic valves was manifestly due to the dilatation of the aortic ring.

For permission to report the above case we are indebted to Dr. James Stewart, and for a report upon the post-mortem findings we are under deep obligation to Dr. Adami.

Case II.—G. R., aged fifty-five years, storeman, was admitted on July 17, 1902, complaining of "kidney trouble," palpitation, and weak-

ness, with faintness on exertion.

He was a large, well-nourished man of fair complexion, the skin of pronounced lemon-color, and the mucous membranes very pale. The patient admitted that many years ago he had used alcohol to excess. At the age of eighteen he had pleurisy on the left side; at the age of thirty, acute articular rheumatism; when fifty-four he had typhoid fever. Further, for the past five years he has been the subject of frequent micturition and burning sensation in the hypogastrium if micturitiou were delayed. For several years sudden stoppage of the stream of urine was often noted by the patient.

An examination of the various systems led to a diagnosis of arteriosclerosis, emphysema, and cystitis with anemia, conforming to the type of secondary anemia rather than to that of pernicious anemia, for when the anemia was most profound the hemoglobin value was 13 per cent., with a red cell count of 1,140,000. Careful microscopic examination of stained specimens of blood failed to discover the more characteristic varieties of blood cells found in pernicious anæmia.

In examining the circulatory system one found that dyspnea and palpitation were very marked on exertion. There was slight cardiac enlargement. The heart sounds at the apex were weak, the first sound being very distant. A soft systolic murmur was heard at the apex, but was not transmitted. At the base both sounds were distant, and over the pulmonary area a loud systolic murmur could be heard.

While under observation in the hospital the patient failed to improve with rest, nourishing diet, and hæmatemics, such as Fowler's solution

and sodium cacodylate. He gradually grew weaker.

Seven days before death, when weakness was profound, a soft diastolic murmur was first observed, with its maximum intensity at the fourth left intercostal space, but plainly heard at the second right costal cartilage and not heard at the apex. On the following day this murmur was yet more marked, but owing to the patient leaving the hospital further opportunities of examination were not possible. Without any other symptoms the patient's strength failed, and he died within a few days.

Through the kindness of Dr. Anderson an autopsy was obtained and the following conditions were found: Chronic cystitis, with a polypoid tumor about the size of a robin's egg springing from the trigone of the bladder. This, no doubt, accounted for the sudden stoppage of the stream as previously noted. The ureters were dilated, and there

was marked double pyonephrosis.

The heart was dilated with some hypertrophy of the left ventricle. Over the right ventricle anteriorly was a small milk patch the size of a five-cent piece. Early and slight atheroma of the norta was noticed. There was no endocarditis. The aortic cusps showed no thickening, nor was there any marked evidence of dilatation of the first portion of the aorta.

Summarizing these cases, with respect to the condition about the aortic valves, we had to deal clinically with a diastolic murmur having all the characteristics of that due to local organic change—a murmur which clinically appeared to arise from no lesion other than that of the semilunar valves—while anatomically we had to deal with cases in which the semilunar valves were perfectly normal in structure. Thus it would appear that we have two genuine cases of relative aortic insufficiency.

Studied in detail these cases show two ways by which this condition may be brought about.

In the first instance, as a result of advanced atheromatous degeneration of the aorta, dilatation of the first portion occurred, rendering the valves, though perfectly normal, relatively incompetent. But while in this case the semilunar valves were found to be insufficient, in the other instance the post-mortem examination showed no leakage whatever at the aortic ring; so that the local changes in the aorta were not sufficient in themselves to account for the clinical phenomena.

In this case, apart from insignificant atheromatous changes in the

first part of the aorta, there were no local organic lesions, but only a pale, flabby condition of the myocardium, such as one would expect to find in association with the anæmia from which the patient had suffered. It is true there was also present a small milk patch on the anterior surface of the heart, but this was apparently of long standing, while it will be remembered the diastolic murmur was discovered but a few days before death.

It is obvious, therefore, an explanation must be sought outside of this, and apart from the causes responsible for the condition in the first instance. The explanation here, doubtless, is to be found in an asthenic condition of the heart muscle, especially of that portion falling under MacCallum's' fourth division, which "encircles the left auriculoventricular ring and the aorta."

It may be of interest to recall in this connection that Osler points out, on Beneke's authority, that "the aortic orifice, which at birth is 20 mm., increases gradually with the growth of the heart, until at one-and-twenty it is about 60 mm. At this it remains until the age of forty, beyond which there is a gradual increase in the size up to the age of eighty, when it may reach 68 to 70 mm." Thus there is, at the very period of life in which sclerosis of the valve is most common, a physiological tendency toward the production of relative insufficiency. In reviewing these two cases it was not our intention to go further

In reviewing these two cases it was not our intention to go further into the various causes of relative aortic insufficiency. This has been fully discussed in the article already quoted. Nor was it intended to discuss the causes of diastolic murmurs other than those originating in or at the aortic orifice. This point is fully dealt with in the same article. Our purpose will have been served if these two cases may find a place beside those already presented.

THE COMMUNITY AND TUBERCULOSIS,2

By Beverley Robinson, M.D., of new york.

Throughout the United States a fair appreciation is now awakened to our duties toward consumptives. This is shown by broad and enlightened work of health boards, by stimulating help from many physicians who have strongly urged their needs, and by contributions of money and effort by laymen and women to build sanatoria.

The sanatoria are of two kinds essentially. First, those where the relatively well-to-do may secure the best care and treatment now recog-

Wood's Reference Handbook of the Medical Sciences, vol. iv. pp. 578-79.
Read before the Climatological Association (to open discussion), Washington, May 14, 1903.

nized, for which, as a rule, a suitable pecuniary return is made. Second, those where the poor, homeless, houseless, friendless patient goes ultimately, to end his days with greater comfort to himself and with less risk to relatives, friends, and people generally. In the latter instance, and as much as may be, provision is also made to receive incipient and slightly advanced cases, which are the more acceptable ones, as they are by far the more curable. In the private sanatoria provision is especially made for the latter sort of cases, and apparently for much the same reason. Within very restricted limits accommodation is also provided for the care of those who are absolutely poor. been done by us hitherto for the dwellers of our tenement houses is very little compared with what has been accomplished abroad-in Germany, France, England-and as nothing, in view of the great and urgent necessities of many thousands of diseased. Happily, some munificent donors have already arisen, and in the Phipps endowment notably we appreciate with gratitude the spirit and doing of generous and instructed private philanthropy. In appeals to State Legislatures and municipalities by boards of health, by physicians, and by citizens for sanatoria to be put under judicious public control, and solely for the benefit of the very poor, we recognize the advent of a better era for very many tuberculous patients hitherto relatively neglected or ignored. Adequate provision doubtless will be made in the near future in the same or different institutions for the best care of such patients, according to the stage of the disease.

To me, the idea of sanatoria for the very poor brings joy and gladness, because I see in it prospect of cure for many; prospect of consolation for many more. To be sure, it will, perhaps, be a long while before we may legitimately hope, even with large and numerous public sanatoria buildings, to meet all requirements of the needy consumptives. But with their existence we shall have accomplished a great and noble, though necessarily limited work, and we shall be able effectively to educate a large and increasing number of sufferers; so that when they return to their homes, stationary, improved, or cured, they will know better how to care for themselves and how to protect others.

As to private sanatoria, especially for the favored ones, and with one or two notable exceptions, I frankly confess I do not feel that the return of health and strength to relatively few patients justifies wholly the outlay of money, labor, notoriety, in behalf of these institutions. I may be misinformed or in error; but in many ways I believe such patients, with their own physicians and with large, sunny, well-ventilated rooms, appropriate surroundings, good food, care, and discipline, in a well-selected location in the country, would enjoy advantages not fairly counterbalanced by excessive doing and overminute regulations (often calculated to do more harm than good) of private sanatoria.

What shall I say of home treatment? To the vast number in our midst at present it is the only available treatment. Even if we could persuade very many among the poor to leave their homes and go elsewhere, there is no institution yet open to receive them. In the city of New York there is now accommodation approximately for 1000 of her consumptive poor; there is requirement for 10,000 to 20,000 more! Fortunately, the day of specifics is passing for all honest and intelligent practitioners. It is useless for enthusiastic or overzealous men to laud and magnify (after very moderate or wholly insufficient experience and cases) this or that drug, this or that preparation or means of cure. Hygiene in its broadest, best sense is after all, our main reliance; and statistics based upon other means, no matter how favorably interpreted by their warm advocates, meet with little cordial response from those who have learned by long experience to become properly skeptical. Most of us now look forward to the bright day when, perhaps, a really efficacious antituberculous serum shall be discovered—not a mere destroyer of bacteria, and perhaps with this destruction great or irremedial injury to the blood or other fluid of the economy—but rather to a serum which shall quickly neutralize or destroy those hitherto unknown toxins, of which the bacteria are but the formed and visible evidence of their presence and action. Better still. May we not even legitimately hope that a serum will be discovered which shall produce, when inoculated, almost absolute immunity from the development of tuberculosis? Surely, the admirable researches of Dr. E. L. Trudeau, at his Saranac Sanatorium, point in the not distant future, perhaps, to the practical realization of this great hope for the race.1

What we want, what we insist upon for our poor, is better ventilation, more and better air, more sunlight, improved plumbing, greater cleanliness in their homes. To these essentials we add good food, properly prepared and served; a pure and plentiful supply of milk and water. Much of all this means of necessity, therefore, improved tenement houses, and under no possible pretext to allow any unjust, iniquitous laws to be passed which would interfere with our ideals or oblige us to take a step backward in our march of progress and greater civilization.

What shall we gain by following out such a plan? First of all, we shall secure a greater resistance on the part of a susceptible or already diseased individual to attack or further inroads of disease; and in this way we shall be doing much toward the ultimate inhibition of tuberculosis. Such an outline as that given above may be helped by judicious medical treatment, and this may be effected in the homes and in the dispensaries.

¹ See paper by Flexner in Philadelphia Medical Journal, February 14, 1903.

My statement has been proven already, I am glad to say (in a limited number of cases up to the present time), by Dr. John F. Russell, of New York City, at the Post-graduate School and Hospital. Russell supports his patients by the administration of various fats in assimilable form, and by due attention to the condition of the prime viæ, while they are submitted at the same time to frequently repeated feeding of appropriate kind. In this way he adds still further to the capital of resistance in the individual patient, which should be our primary object to develop, foster, and maintain. Many of Dr. Russell's patients have recovered; many more, as the years roll on and the number of his patients increases, will recover. Dr. Russell's ideas are based somewhat, doubtless, upon the facts fully made known to us twenty-five years ago by the late Professor Austin Flint-i. e., that pulmonary tuberculosis was a self-limited disease (taking all cases), in the proportion of 1 to 15, and even in the midst of unsanitary surroundings, which up to the present time, unfortunately, are so usually the lot of the poor. It is only rational, therefore, to believe that with improved surroundings, and better care and treatment, a far larger proportion would recover.

In our efforts, however, to improve or abolish the nests of disease we must never lose sight of the broadest humanity for the sufferer. Do not make him a social outcast! He is already sufficiently stricken. Do not add to his misery! Many patients who are unquestionably phthisical may still do light and healthful work and continue to improve physically, and, indeed, ultimately recover. Is not this fact of immense importance? And not merely because it keeps hope and courage alive, but also because, from a material and purely economical standpoint, it saves much money to the State, which otherwise is morally bound to be the caretaker and supporter of the doubly afflicted poor.

But it is often proclaimed that such people—the tuberculous—are a constant imminent danger to others—to the well ones. This is not true if the patients affected with pulmonary tuberculosis be properly instructed and disciplined in their homes and places of employment. It cannot be too strongly insisted upon and too widely circulated that tuberculosis is not contagious in the ordinary sense of this word, and in the same way the eruptive fevers, for example, are contagious, through a third person or through the air of the patient's room. One may be as safe in the room of a phthisical patient as anywhere else, provided, of course, every rational and important precaution and observance be upheld to prevent infection. The disease is infectious and communicable—that we know; but, once more, this statement does not mean that it is contagious.

Viewed differently, what do we see? The crudest expressions of dire ignorance on the one hand, and extended inhumanity on the other.

People who have a foolish, unreasonable dread become immediately unreasoning, unkind, inhumane, un-Christian. In certain of our States and Territories they have wished to enact laws to prevent consumptives from entering their borders. The National Government has even been requested to prevent consumptives from coming to the United States from foreign countries, and only so far back as 1901 the Treasury Department of the United States decided to classify pulmonary tuberculosis with dangerous contagious diseases and to exclude all consumptive immigrants from entering the United States. Thanks to the intelligence, broad-mindedness, and, above all, the humanity of the medical profession, this order was strongly opposed. Thus far, unfortunately, their laudable efforts have remained without effect upon the powers that be.

On February 20, 1903, I received a letter from the Commissioner of United States Immigration Service stating that "the statute is enforced in accordance with the opinion" expressed by the Surgeon-General of the Marine-Hospital Service—i. e., that "tubercle of the lung is a dangerous contagious disease."

In the Adirondacks, where formerly consumptives encountered only affection, love, care, attention, sympathy, in many instances they are now almost outlawed at times from getting proper shelter and food, and simply because the "poor blind ones" imagine they will contract a terrible disease by reason of contact. This leads me to say what I believe to be very important—that after all hygienic rules are obeyed and all precautionary rules laid down and insisted upon, to protect the healthy and also to prevent reinfection of the diseased it is essential among the poor to provide proper disinfectants, spit-cups, and paper napkins for sputa. In the outline of home treatment in the new Phipps Sanatorium this rule of action on the part of physicians or care-takers of the poor is duly and forcibly emphasized.

Finally, the broad statement still remains true, that without a susceptible soil no tuberculosis will develop in the vast majority of cases. Witness a little experience of my own. I served thirteen years in the Out-door Department of the New York Hospital, where I had the class either of heart and lungs or throat and nose. During that time I had three or more assistants at different times, and several students. I or my assistants passed at least two hours three times a week in the room where the patients were examined, treated, and prescribed for. In no instance that I recall was anyone among my assistants or students (of course, including myself) known to have contracted tuberculosis, and certainly in no instance was our attention directed to the room of the New York Hospital as being the source and origin of the disease.

So far as I know, at no time in the thirteen years referred to above was the room where I examined and worked over my cases ever thor-

oughly disinfected in accord with the notions that we now possess of the meaning of the term. Of course, patients coughed, expectorated, and frequently tuberculous sputa reached the floor, dried up, and were wafted freely later to the respiratory tract of us all.

On the other hand, with a susceptible soil, the development of the disease is very largely preventable, always supposing that we insist upon the observance of rules, with this object in view, which we know and believe to be necessary. Shall we rid ourselves entirely of pulmonary phthisis? Perhaps not very soon, in view of all the numerous bad conditions of modern life, especially in our great centres of population and among the very poor, who are obliged to start in life, being the possessors of that hereditary susceptibility to disease which proceeds from one or more generations, probably, of corroding care, unrelaxed labor, lack of proper lodgings, food, air, and sunlight. But with improvement, amelioration, a far better state of affairs is sure to come.

Suppose this to be an "ignis fatuus"—as some may call it—we may even then at least hope that "probably, in future years, tuberculosis may be a comparatively rare and negligible ailment; but if this is to be, it will be through rational and humane methods, and not reckless exaggeration and stimulation of insane public fears, with their natural result of brutal inhumanity to the unfortunate."

To show to what lengths this inhumane spirit even in our profession may go I have only to cite the writer of an article, lately published in one of the leading New York medical weeklies,² who appears to charge many consumptives "with a deliberate criminal tendency to spread their disorder."

To show the other side of the picture and the one we would dwell upon, believe, and know to be true, I will cite from an article in the current issue of *Charities* (February, 1903):

"There is at present," the article states, "no other disease which is receiving so much attention at the hands of social and philanthropic workers. One reason may be that its cause is so well defined and the methods whereby its spread can be prevented are so simple that they may be easily grasped by the public. There is reason to believe that within a comparatively short time the United States will have as complete an organization for the prevention of tuberculosis as any to be found in Europe."

To my mind, tent life is the perfect life for consumptives or those threatened with the dread disease, for in this way, and in this way alone, may they keep their lungs filled all the time with the best air possible; and by adoption of this method of treatment we have a guar-

¹ Journal of the American Medical Association, November 15, 1902, p. 1259.

² New York Medical Journal, February 8, 1902, p. 238.

³ Journal of the American Medical Association, loc. cit.

anty of cure in certain cases where it appears to be almost essential, if this most desired result is to be attained. For this reason I believe, independently of the questions of less expense and larger numbers provided for, the New York Board of Health has wisely determined to adopt the method of tent treatment of the consumptive poor in the incipient or primary stage of disease, whose cases it may be able later properly to care for.

No doubt, also, the amount of exercise judiciously proportioned in individual cases, which to many a camp life almost necessitates, is additionally a reason why tent life is an ideal life for these sufferers. Keeping the tent "shipshape," or keeping the camp cleanly, orderly, attractive, is surely useful and beneficial work for them. Their minds are agreeably occupied, and their bodies freshened and strengthened in performing the tasks, with this object in view, duly assigned to them.

Except in the febrile exacerbations of the disease, or in cases of extreme weakness, there are few instances in which tuberculous patients will not obtain distinct advantages from this mode of life over any other, provided, of course, the tent or camp life is followed in a desirable locality and with ambient surroundings in every way hygienic.

Latterly, Dr. A. Mansfield Holmes' called particular "attention to the essentials of an ideal tent cottage, and gave rules for governing tent life." . . . "A model of the tent cottage adopted by the Rocky Mountain Industrial Sanatorium was exhibited" by him before the Mississippi Valley Medical Association, "showing improved methods of construction and ventilation."

AN EPIDEMIC OF TYPHOID FEVER DUE TO IMPURE ICE.

BY R. H. HUTCHINGS, M.D.,

ANI

A. W. Wheeler, M.D., st. lawrence state hospital, ogdensburg, n. y.

THE St. Lawrence State Hospital is situated on the St. Lawrence River, three miles below the city of Ogdensburg. At this point the river is a mile and a quarter wide, has an average depth of from twelve to twenty feet, and the current is three miles per hour. This was the source of the water for the hospital from its organization in December, 1890, until December, 1900, the intake pipe extending two hundred feet from the shore into swift water, and to a depth of sixteen feet, on a rocky bottom. The water supply was considered ideal by the founders of the institution, who pointed to the great volume of the river, the

comparatively rapid current, and the rocky formation of the river bed, and argued that the danger of contamination from the Ogdensburg sewers was reduced to an infinitesimal quantity; yet, within two months from the occupation of the first building, typhoid fever made its appearance and was practically endemic for ten years, increasing steadily with the growth of the population from two cases the first year to forty in 1900. In September, 1895, at the request of the superintendent, the State Board of Health made an investigation of the prevalence of typhoid fever in the hospital, and the report by Dr. F. C. Curtis embodied the following conclusion: "I would report that it is my opinion that this water supply (the St. Lawrence River) is the source of the endemic. 1. Because the other common sources for the development and spread of typhoid fever may all be excluded. Because the characteristics of the endemic are those of such a constantly acting cause. 3. Because in the vast majority of cases the epidemic or endemic prevalence of typhoid fever is due to a contaminated water supply. In the present case we have a navigated and sewage-bearing stream used as the source of supply." Previous to this investigation the water had been tested chemically and bacteriologically with negative results. All observers agreed in the correctness of this conclusion, and it is not likely that ice at that time contributed in any appreciable degree as a causative factor. There are several reasons for this belief, one of which will suffice here, and that is in the earlier years each ward had its own drinking fountain, where the water was cooled in an ice chamber in the basement, and ice was not put into water or milk.

Boiled water was then provided for drinking and every effort made to prevent employés and patients using water from the faucets for that purpose. By this means the disease was kept in check to some extent; but employés would become careless after a time when there was no sickness to remind them of it, and many of the patients, from delusions of poisoning or for other reasons, refused the boiled water and drank from the faucets in the layatories.

Various measures for purification were investigated, and it was finally decided to abandon the St. Lawrence River and obtain water from the Oswegatchie River, a small Adirondack stream, from which the city of Ogdensburg is supplied, by extending our mains to connect with those of the city. This was done in December, 1900, and with the exception of two cases which occurred about the time the change was made, and probably contracted previously, there were no cases of typhoid that were not clearly contracted elsewhere until October, 1902. During this period of twenty-one months water was not boiled and ice was freely used as an article of food by both patients and employés.

On October 2d three attendants in the same building were reported ill with fever, headache, and malaise; on the 3d, two others with like

symptoms; on the 4th another case occurred; on the following day two others, making eight within four days. The symptoms presented by these early cases were principally of a nervous type; there was intense aching in the back and limbs, insomnia, headache, restlessness, and dry cough. The temperature of several of the patients reached 103° to 104° F. the first day.

The disease was considered epidemic influenza until toward the end of the first week, when the rash and other symptoms of typhoid made the diagnosis no longer doubtful. Of the eight persons first attacked, seven were employes who ate in the same dining-room, and the other was a woman patient who had been working there. The local conditions about this dining-room and kitchen were thoroughly inspected, with negative result; the milk is obtained from our own herd and could not have been infected. All the containers were sterilized twice daily, no water was used except from the faucets, and there had been no fever among the men working in the barns. The possibility of infection from vegetables and oysters was eliminated after investigation. Inquiry of the health department of the city showed that typhoid was not prevalent there among users of the Oswegatchie water. remained only the ice to be considered, and one point of interest in this connection is that about six days before the first cases developed a new ice-house had been opened from which none had been previously withdrawn this year. The ice had been taken from the St. Lawrence River and had been stored since February, a period of more than seven months, and though gathered from the same spot as that in house No. 1, it was at a different time. Dr. John W. Benton, health officer of the city of Ogdensburg, informs us that during the months of January and February, 1902, when this ice was forming, there were three or four cases of typhoid fever in the city among users of well-water. None of them was verified by autopsy, but he thought there could be no question as to the nature of the disease. The temperature prevailing during the week the ice was being stored was, according to the records of the Weather Bureau observer at this point-maximum, 14° F.; minimum, -1° F. The ice was cut from the same spot during the past twelve years but one, and was never before suspected of conveying disease.

A specimen of drinking water and one of melted ice was sent at once to the Bender Laboratory in Albany, N. Y., for bacteriological examination. The ice selected was clear and free from extraneous matter. The report of the director, Dr. George Blumer, is in part as follows: "Specimen No. 1, drinking water (Oswegatchie). Number of bacteria per cubic centimetre on agar plates, 11,000; on gelatin plates, 3600. The fermentation test showed no gas in eight tubes, each treated with one cubic centimetre of water. Specimen No. 2, melted ice (St. Law-

rence). Number of bacteria per cubic centimetre on agar plates, 30,400; on gelatin plates, 50,400. Out of eight fermentation tubes inoculated three showed definite evidence of organic contamination in the form of the colon bacillus." This report from so excellent an authority satisfied us that the contagion of typhoid was in all probability in the ice from ice-house No. 2, and we began an investigation in the laboratory of the St. Lawrence State Hospital to determine whether or not the bacillus typhosus could be isolated from it.

We examined the stock of ice, and found that some of the cakes contained foreign substance in the form of black or dark brown, granular matter, solidly frozen in the ice. These cakes were broken and the portions containing the foreign matter removed. The cakes were about sixteen inches in thickness, and the portions selected were, as near as possible, from the centre. We were careful to choose no snow ice. These fragments were melted in a clean vessel at room temperature, after which a considerable black sediment was deposited in the Examined under the microscope with low power it appeared as black, homogeneous masses; with the 1 objective the field was crowded with organisms, many of which were motile. Cultures made from the sediment and the water, in bouillon, showed a rapid growth, with fecal odor in all the tubes. Series of plates were then prepared from these cultures by the usual method, and well-defined colonies were isolated in the end plates.

Five colonies were selected which presented characteristics resembling the typhoid bacillus, and fresh cultures were made from them. Of these cultures three proved to be the colon bacillus, one was a bacillus not identified, while the fifth was a pure culture of the typhoid bacillus, as shown by the following tests: On nutrient agar it grows readily; in broth no pellicle is formed; in lactose media no fermentation occurs; on potato the growth is invisible; in litmus milk the reaction is faintly alkaline and no coagulation occurs; with the serum of typhoid fever patients characteristic clumping is produced; it is an actively motile bacillus having the appearance of the bacillus typhosus. The disease was identified clinically by autopsies in three of the cases, in all of which the intestinal and abdominal lesions were demonstrated.

In "An Investigation of the Boston Ice Supply," in 1901, conducted by the board of health, the work of Sedgwick, Winslow, and Park is reviewed and the following statement made: "These considerations show that ice more than three weeks old is sanitarily as safe as a well-filtered water supply. Cases of typhoid fever, due to ice, might naturally be expected to occur, if at all, at the time immediately following the cutting of infected ice, and as this is done in

¹ Boston Medical and Surgical Journal, vol. cxlv. p. 557.

January usually, after March at latest the ice could hardly be held responsible for any trouble, even were it known to be infected." It should be borne in mind, however, that the work of the authorities referred to and upon which this conclusion is based was done under artificial conditions, and in its natural environment the bacillus now appears to have a greater resistance, not heretofore recognized. In our review of the literature we have been unable to find any similar cases reported, and in the article quoted the statement is made that only a single authentic case is on record.

With the discontinuance of the use of the infected ice the epidemic gradually subsided. There were in all thirty-nine cases, the last of which developed in November. Our water is not boiled, and the conditions, with the exception of the ice, are the same as at the beginning of the epidemic.

THE TRANSMISSION OF BOVINE TUBERCULOSIS BY MILK, WITH A TABULATION OF EIGHTY-SIX CASES.

By George M. Kober, M.D.,

Professor of Hygiene, school of Medicine, Georgetown University, Washington, D. C.

THE agency of milk in the causation of scrofula was referred to by Carmichael in his Essay on the Nature of Scrofula, with Evidence of its Origin from Disorders of the Digestive Organs, London, 1810, in which he refers to acescent (sour) diet, especially of cow's milk, as a frequent cause. On page 50 he says: "Infants at the time of weaning are from the change of diet particularly subject to bowel complaints, too often followed by disease of the mesenteric and lymphatic glands."

He quotes Richard Wiseman (1626-1686), White (1787), and Lieutand to show that whenever the outward glands appear swollen, one may safely conclude the mesenteric to be so, too, they being usually the first part that is attacked by this malady. Indeed, Carmichael, while he never saw a subject in the dissecting-room with strumous glands externally without a similar state of those of the mesentery, claims that he has very frequently seen the latter unaccompanied by any affection of the external glands, which to his mind indicates that in scrofula the mesenteric glands are the first involved.

While Carmichael did not attempt to prove the transmission of scrofula in the milk of diseased cows, he points with emphasis to the use of sour milk, and on page 101, remarks:

"With respect to the disease in question, we know that swine are so subject to one very similar that scrofula has in consequence derived its name

from those animals, and certainly their extraordinary fondness for acceptate food corroborates in some degree the foregoing opinion. Swine, it is well known, fatten upon buttermilk and upon the sour liquid formed in starch manufacture during the steeping of wheat."

These are suggestive statements, especially as, in the opinion of veterinarians of the present day, tuberculosis is increasing among swine, largely as a result of consuming tuberculous milk. According to Salmon,2 during the year 1900, of 23,336,884 hogs slaughtered under Federal inspection, 5444 were sufficiently affected to eause condemnation of some part of the careass.

Casper,3 in his Characteristics of French Medicine, etc., published in 1822, on page 124, writes:

"Scrofula is not more rare in Paris than elsewhere, and baffles also here the efforts of physicians. La Billardière declares that the majority of milch cows in Paris perish from nodular consumption, and that their milk contains seven times more of lime phosphate than common. It is possible that there is a connection between this phenomenon and the many tuberculous diseases among the children in Paris. We cannot pursue here this investigation, where the mere fact suffices that in Paris, especially in the hospitals for foundlings and for children, like the St. Louis and others, the sequela and effects of scrofula can be seen in astonishing numbers."

La Billardière's statement that the milk of tuberculous cows contains seven times more of lime phosphate than common is of special interest in view of Dr. de Schweinitz's recent biochemical researches upon bovine, swine, avian, virulent human, and attenuated human tuberele bacilli, in which he calls attention to the large amount of phosphoric acid obtained from the germs, and also points out that the conclusions which might be drawn from these analyses indicate a closer resemblance in the composition of the germs between the moderately virulent human and the very attenuated human bacilli.

Klencke,6 in 1846, was the first to write on the infectiousness and transmission of scrofula by eow's milk. In his book of ninety pages he gives the clinical histories of sixteen children who had been fed with the milk of scrofulous and tuberculous cows, and they all point to tuberculosis of either the intestines, glands, skin, or bone. He also describes the condition of the seven suspected cows, and verified the diagnosis of a "scrofulous-tuberculous condition" in four post-mortem examinations of the cows, which demonstrated to his satisfaction "that the same scrofulous lesions may be developed in the cow as are found in the human subject and that human scrofula and the disease found in the mammalia are identical." The details of these eases were republished by the writer in 1895.

Klencke's contribution to the early literature of this subject may be regarded of special value, as he was one of the first to demonstrate the infectious nature of tuberculosis by injecting, in 1843,7 human tuberculous matter into the cervical veins of rabbits, causing pulmonary and hepatic tuberculosis in these animals In passing it should be stated that inoculation experiments had been made by Kortum (1789), Hébréad (1802), Salmade (1805), Goodlad and Deygallières (1829), Lepelletier (1830), and Laennec and Erdt (1834). These experiments naturally paved the way for Villemin's brilliant and positive demonstrations in 1865.

Since that time numerous instances of artificial tuberculosis have been reported, the experiments having been performed on heifers, calves, goats, swine, guinea-pigs, rabbits, and dogs; so, for instance, under the heading of subcutaneous inoculation methods may be mentioned the work of Soujou and Court Paul, ¹⁰ Gerlach, ¹¹ Günther and Harms, ¹² Rivolto and Perroncito, ¹³ Bagge, ¹⁴ Zürn, ¹⁵ Bollinger, ¹⁶ Biffi and Verga, ¹⁷ Bouley, ¹⁸ Aufrecht, ¹⁹ Toussaint, ²⁰ and others. Intraperitoneal inoculations were reported by Klebs, ²¹ 1870, Bollinger, ¹⁶ 1873, and Kitt, ²² 1878. Intravascular inoculations were reported by Semmer, Thal, and Nesterow. ²³ Intraocular inoculations were reported by Cohnheim and Salomonson, ²⁴ Hänsell and Deutschmann, ²⁵ and Baumgarten; ²⁶ and finally the inhalation experiments by Tappeiner, ²⁷ Lippl, Reinstadler and Bertheau²⁸ may be cited.

It is true that opposing views were held and quite a number of negative experiments have been reported, but on the whole the results were sufficiently numerous and uniform to demonstrate the identity of scrofula and tuberculosis and the intercommunicability of tuberculosis in animals and man. This evidence was materially strengthened by the feeding experiments of Gerlach, ²⁹ Chauveau, ³⁰ Bollinger, ³¹ Klebs, ²¹ Zürn, ¹⁵ Roloff, ³² Brell, ³³ Metzguer, ³⁴ Langeron, ³⁵ Blumenberg, ³⁶ Orth, ³⁷ Lange, ³⁸ Peuch, ³⁹ Peuch and Toussaint, ⁴⁰ Aufrecht, ⁴¹ and others.

Bollinger⁴² in the discussion of artificial tuberculosis before the German Naturalists and Physicians in 1879 (which was participated in by v. Recklinghausen, Arnold, Birch-Hirschfeld and Fränkel) had no hesitation in declaring that milk from tuberculous cows is largely responsible for the production of scrofula, which affects about 70 per cent. of the children in Munich.

E. Klebs, 43 from his experiments in 1871–1873, concluded that milk from tuberculous cows produces tuberculosis in different animals; that the disease commonly begins with an intestinal catarrh, followed by tuberculous affections of the mesenteric glands, involvement of the liver and spleen, and finally by extensive miliary tuberculosis of the pulmon-

ary organs, and Virchow, ⁴⁴ in 1880, suggested that bovine tuberculosis may be conveyed in the milk, especially if the udder be the seat of the lesion. In the meantime a number of cases of transmission of bovine tuberculosis in milk had been reported by Schoengen, ⁴⁵ Leonhardt, ⁴⁶ Bollinger and Stang, ⁴⁷ Demme, ⁴⁸ Epstein, ⁴⁹ Uffelmann, ⁵⁰ Johne, ⁸ and Law. ⁵¹ Creighton, ⁵² in 1881, published a book on bovine tuberculosis in which he presents a minute study of a number of cases of tuberculosis in man which had the characteristics of an infection and at the same time a suggestive likeness in the morbid products to the bovine form of tuberculosis (perlsucht). Indeed, the evidence on this subject appeared sufficiently strong to justify Koch, ⁵³ in 1882, in declaring:

"It is not the peculiar structure of the tubercle, nor its lack of bloodvessels, nor the presence of giant cells, that will give the solution, but rather the proof of the tuberculosis bacillus, whether it be in the tissue by means of staining reaction or whether it be by means of culture upon coagulated blood serum. This criterion being adopted as a foundation principle, according to my investigations miliary tuberculosis, caseous pneumonia, caseous bronchitis, intestinal and glandular tuberculosis, bovine tuberculosis, spontaneous and inoculation tuberculosis of animals must be declared as identical. . . Bovine tuberculosis is identical with human tuberculosis, and, therefore, a disease transmissible to man. It should be treated just like other infectious diseases transmissible from animals to human beings. However great or small may be the danger which results from the consumption of meat or milk affected with bovine tuberculosis, it is present, and must be, therefore, avoided.

Soon after Koch's discovery of the tubercle bacillus diligent search was made for the presence of this organism in the milk of diseased cows, and it was demonstrated by Csokor, ⁵⁴ Bang, ⁵⁵ Johne, ⁵⁶ Bollinger, ⁵⁷ May, ⁵⁸ Ernst, ⁵⁹ Woodhead and MacFadyean, ⁶⁰ Martin, ⁶¹ Nocard, ⁶² Stein, ⁶³ Hirschberger, ⁶⁴ and others. Some observers, notably Martin ⁶¹ and Nocard, ⁶² found that milk was infective only when the udder was itself the seat of tuberculous lesions; but Ernst, as early as 1889, and Theobald Smith, ⁶⁵ in 1893, from a number of experimental observations, concluded that tubercle bacilli may be present in the milk of tuberculous cows when the udder, so far as the naked eye could tell, contained no focus of disease. These conclusions are, moreover, supported by the investigations of Bang, Stein, Bollinger, Adami, Delépine, and Hirschberger.

Quite a number of observers failed to find tubercle bacilli in the milk of tuberculous animals; but May⁵⁵ and Hirschberger⁶⁴ proved that inoculation experiments are the more certain guide as to whether milk is infectious or not, since they obtained positive results from milk of undoubtedly tuberculous animals in which they were unable to demonstrate the presence of tubercle bacilli. As a matter of fact, Rabinowitsch and Kempener⁶⁶ obtained positive results

in inoculation experiments with the milk of ten out of fifteen cows that had reacted to tuberculin, and only two of these animals revealed udder lesions.

The general results of inoculation experiments differ in different countries, and naturally vary with the prevalence of bovine tuberculosis, the mode of technic, and many other factors.

The reports indicate that the infectious qualities are greatest with milk from animals with udder lesions, and next from those affected with general tuberculosis.

Bollinger⁵⁷ found that the general market milk of Munich proved infectious in 16.6 per cent. of the animals; Martin in Paris, in 33 per cent.; Bang in Copenhagen, in 15.5 per cent.; Ernst in Boston, in 12 per cent.; Fiorentini in Milan, in 10 per cent.; Rabinowitsch, in 28 per cent.; Obermüller, in 7.5 per cent.; Paris Municipal Laboratory, in 40 per cent.; Hamilton, Boyce, Woodhead, and Delépine in Liverpool, in 29 per cent.; Delépine in Manchester, in 25 per cent.; Massone, in 9 per cent.; Ott, in 11.6 per cent.; Jäger in Königsberg, in 7 per cent.; Kanthack and Sladen⁶³ found more than 50 per cent. of the milk supplied to the college in Cambridge infectious.

The experiments reported by Schmidt-Mühlheim, May, Stein, Hirschberger and Bang, and which were made with milk from tuber-culous cows, proved successful in 60 to 70 per cent. of the animals.

In addition and, perhaps, of greater importance to the subject are, of course, the feeding experiments. Disregarding the earlier experiments of Gerlach and Bollinger, we have the important and positive results obtained by Baumgarten,70 Wesener,71 Fischer,72 Peuch,73 Ernst,74 Bang,55 Falk,75 Zagari,76 and Gebhardt,77 showing that after a variable period, usually between eleven and twelve weeks, the ingestion of tuberculous milk developed a classical tuberculosis either of the intestinal mucosa and mesenteric glands, or spleen and liver, followed by subsequent involvement of other organs. In some, but not many, of these cases there was evidence of primary intestinal tuberculosis, but almost all of the cases revealed infection of the mesenteric glands. In the cases where the primary lesions were found elsewhere than in the intestines or mesenteric glands, Wesener,71 in 1885, suggested that the bacilli must have found their way into the general circulation. As a matter of fact, the experiments of Dobroklonski,78 Desoubry and Porcher,79 of Nicolas and Descos,80 have since shown that microbes may pass through the intestinal wall and enter the thoracic duct. The last-named experimenters, in 1902, brought out the interesting fact that three hours after the ingestion of tubercle bacilli the chyle and the lymph of the thoracic duct may contain bacilli in sufficient number to infect a guinea-pig, and we know from Wyssokowitschky'ssi experiments that from eight to thirty virulent tubercle

bacilli introduced into the peritoneal cavity of a guinea-pig are required to bring about infection.

It should be stated that in the feeding experiments by Günther and Harms, ⁸² Siedamgrotzky, ⁸³ Roloff, ⁵² Bollinger, ⁴² and Nosotti the results were not uniformly successful, and that Schreiber, ⁸⁵ Günther and Harms ⁸² have reported negative results.

On the whole, however, the feeding experiments with tuberculous milk proved infectious in about 45 to 50 per cent. of the cases. This seems excessive, probably because many of the negative results were never reported.

Apart from these experiments, we have the reports of Lucas and Morro, ⁸⁶ Utz, ⁸⁷ Klebs, ⁸⁸ Kruckow, ⁸⁹ Pfennigwerth, ⁹⁰ Vollers, ⁹¹ Woodhead, ⁹² and others to show that the disease may be transmitted in milk to calves and pigs and other animals.

It is interesting to note that Bang,⁵⁵ May,⁵⁸ and Woodhead⁶⁰ noted a marked difference in the resulting lesions with raw milk and milk which had been subjected to different degrees of temperature. So, for example, Bang found that while a temperature of 158° F. did not destroy the vitality of the organisms, it reduced their virulence; and Woodhead, by the operation of certain low temperatures, obtained a diminution in the virulence of the tuberculous material in milk, which then "became so tardy in its operation on the test animals as to simulate the slower forms of consumption seen in the human subject, or when used to feed pigs—animals having some specialties of throat structure like that of man—gave rise to chronic enlargement of the throat glands resembling the serofulous glands so common in children."

In the meantime 56 additional cases of transmission of bovine tuberculosis through the medium of the milk supply had been reported by Law, 93 Demme, 94 Sonntag, 69 Meyerhoff, 95 Hermsdorff, 96 Northrup, 97 Ollivier, 98 Wyss, 99 Gosse, 100 Rotch and de Schweinitz, 102 Law, 103 Rich, 104 J. L. Smith, 105 Ernst, 74 Brouardell, 106 Von Ruck, 107 Hills, 108 Prümers, 109 and Bovaird. 109 A number of accidental inoculations (wound infections) in man with bovine bacilli had also been placed on record by Pfeiffer, 110 Hartzell, 111 Rich, 104 Tscherning, 112 Law, 113 Ravenel, 114 Naughton 115. These and the cases reported by Grothan, 116 Coppez, 117 and Priester 118 of primary subcutaneous tuberculosis caused by the topical application of cream, infection in milking, and the introduction of infected milk in the attempt to remove tattoo marks, had materially strengthened the evidence as to the transmissibility of bovine tuberculosis to man. Indeed, the absolute

identity of tubercle bacilli infecting mammalia was generally assumed until Theobald Smith, ii in 1896, presented to the Association of American Physicians a comparative study of a bovine bacillus and a presumably human bacillus in which the morphological and biological differences were sufficiently marked to suggest further study; and as a result of this research Smith, 120 in 1898, stated that "we are justified p lif only to guide and stimulate further study in establishing a distinctively human or sputum and a bovine variety of the tubercle bacillus." He also expressed the opinion that the comparative study of the tubercle bacilli will lead to some definite understanding on certain important questions and eventually to more light on the whole subject of tuberculosis from the preventive as well as the therapeutic side. Notwithstanding these facts and the observations of Martin, 61 in 1895, that human sputum was far less virulent for animals than was bovine tuberculous material, the announcement of Koch before the International Congress for the Prevention of Tuberculosis, held in London July 22 to 26, 1901, was received with astonishment, especially since his conclusions carry with it a reversal of his judgment rendered in 1882.

Koch, in his address of 1901, makes the following declarations:121

"1. The bacilli found in cases of bovine tuberculosis are much more virulent for cattle and other domestic quadrupeds than the bacilli found in cases of human tuberculosis.

"2. This difference is so marked and so constant that it may be relied upon as a means of distinguishing the bacilli of bovine tuberculosis from those of the human disease, even assuming that the former may occasionally

be found as a cause of disease in man.

"3. If bovine bacilli are capable of causing disease in man, there are abundant opportunities for the transference of the bacilli from the one species abundant opportunities for the transference of the dacin from the one species to the other, and cases of primary intestinal tuberculosis from the consumption of tuberculous milk ought to be of common occurrence. But post-mortem examination of human beings proves that cases of primary intestinal tuberculosis are extremely rare in man, and, therefore, it must be concluded that the human subject is immune against infection with the bovine bacilli, or is so slightly susceptible that it is not necessary to take any steps to counteract the risk of infection in this way."

Therefore, Transferrence of the dacin from the one species to the consumption of tuberculosis from the c

Fortunately for the advancement of science, opposition fosters the spirit of inquiry, and many experiments have been made which have shed new light upon the already voluminous testimony. true that the results in the feeding experiments with human sputum have varied, and that some of the earlier experimenters have reported negative results, the weight of the testimony is clearly in favor of the intercommunicability of human and bovine tuberculosis; and the experiments made during the past two years by Ravenel,122 de Schweinitz, 123 Mohler, 123 Orth, 124 de Jong, 125 Stenström, 125 Fibiger, 125

Wolff,¹²⁵ Nocard,¹²⁵ Arloing,¹²⁵ v. Behring,¹²⁵ Dean and Todd,¹²⁵ and Cipollina¹³⁵ conclusively demonstrate that cattle are not refractory to human tuberculosis and that bovinc tuberculosis may be transmitted to monkeys. Whatever differences have been observed may very properly be attributed to the condition of the host and to the different degrees of virulence found in human bacilli, as shown by the work of Vagedes,¹²⁶ 1896, Lartigan,¹²⁷ and Delépine.¹²⁸

The former studied twenty-eight human cultures, and found one much more virulent than the others and even more virulent than either of the two bovine cultures. Lartigan found bacilli of different degrees of virulence in human tuberculosis, and one of his specimens presented morphological and cultural peculiarities which suggested the bovine origin described by Smith. Delépine obtained from the human subject bacilli just as virulent as the bovine organisms, although in most instances the human tubercle bacillus was less virulent.

The writer has tabulated 86 cases of milk bovine tuberculosis, and quite a large number of cases of transmission of bovine tuberculosis to man have been reported by Krause, ¹²⁸ Ravenel, ¹²⁹ Lassar, ¹²⁵ Hüls, ¹²⁵ Spronck and Hoefnagel, ¹²⁵ and Troje. ¹³⁷ New light has also been shed upon the extent of intestinal infection by the statistics of Heller, ¹³⁰ who finds that in 714 autopsies in children who died from diphtheria 140 (19.6 per cent.) were tuberculous, and of these 30.7 per cent. showed primary lesions in the intestines or mesenteric glands; 2 (1.43 per cent.) showed primary intestinal tuberculosis; 8 (5.7 per cent.) showed primary mesenteric glands; and 33 (23.5 per cent.) showed primary mesenteric gland tuberculosis.

Bovaird's¹³¹ collection of primary intestinal tuberculosis in children is summarized as follows:

						Total.	Intestinal.	Per cent.
German						236	9	4
French						128	0	0
English						748	136	18
American	_					369	5	1

Dr. Bovaird confesses his inability to understand or explain the difference. The facts are that the post-mortem returns are extremely conflicting, and, unless accounted for by a variable prevalence of bovine tuberculosis and the habit of feeding raw or sterilized milk, suggest the necessity of more careful post-mortem work.

The statistical work by Gottstein¹³² shows that the mortality from tuberculosis in breast-fed children is but slightly more than half as much as among those otherwise nourished, the proportion being as 6:10. Salmon¹³³ has analyzed the vital statistics of Massachusetts

and finds an increase of 36 per cent. in the forms of tuberculosis other than phthisis in the class under five years of age, while there was a reduction in the mortality of phthisis at all other ages of about 45 per cent., and the vital statistics of Michigan from 1885 to 1900 show also a tremendous increase during the milk-drinking age.

Dr. Hand's136 statistics are as follows:

Total number of autopsies								Per cent.
Total number showing tuberculosis .								34.6
Apparent portal of infection (Hutinel's tu Oldest lesion in the bronchial glands							75	62.2
Oldest lesion in the mesenteric glands								8.7
Process so general that the portal could	not	De ae	eterm	nned	 •	•	27	23.4

The cases of milk-borne tuberculosis, now numbering 86, while not as large as commonly supposed, are considerable when we consider the difficulty of tracing the infection on account of the more insidious character of the disease. In this connection we should remember that the first milk-typhoid epidemic was reported by Jacobs in 1858; in 1881 Mr. Ernst Hart had collected fifty epidemics, and in 1900 the writer tabulated 195 such epidemics. The opportunities for tracing bovine infection are much better in small communities and in isolated farm-houses than in large cities, and we should look to the country practitioner for help; he, in turn, unless properly equipped to verify his diagnosis, should apply to the Bureau of Animal Industry, or to the pathologist and bacteriologist of his medical school to check up his work.

A careful review of the cases recorded, when taken in connection with the laboratory experiments and the general evidence, justifies the following conclusions:

- 1. Tuberculosis may be transmitted to man in milk from tuberculous cows. The danger from this source is real and cannot be measured by the actual number of recorded cases, but should be judged in part, at least, by the inoculation and feeding experiments and the accidental wound infections which have established the intercommunicability of bovine and human tuberculosis.
- 2. The degree of danger may also be estimated by the prevalence of bovine tuberculosis and of the forms other than phthis pulmonalis in man, remembering that the infectious qualities of milk are greatest when the udder is the seat of lesions, and that Gebhardt's experiments have shown that tuberculous milk when diluted with the milk of sound animals in the proportion of 1:40 lost its infective power.
- 3. The experimental studies also indicate that while the bacilli of human tuberculosis possess different degrees of pathogenic power and

are often of feeble virulence for cattle, Koch's assumption that human and bovine tuberculosis are distinct and that human tuberculosis cannot be conveyed to cattle appears to be disproved, and his failure to secure similar results may be attributed to the use of human bacilli of diminished virulence.

- 4. Recent investigations have strengthened Smith's claim that there are two types of tubercle bacilli—the so-called bovine and human types, possessing certain morphological and biological differences; but it has also been shown that virulent cultures may be obtained from both of these types, which when inoculated into animals produce the disease in question.
- 5. Further research seems desirable with a view of determining the frequency of primary intestinal and abdominal tuberculosis in all cases which come to autopsy, whether the child perished from tuberculosis or not; and in these autopsies the bacteriological examination should be directed to the existence of the two types of tubercle bacilli originally referred to by Smith, and whether the bovine type predominates in the so-called scrofulous lesions.
- 6. Careful chemical analyses of the milk of tuberculous animals should be made with a view of determining the amount of phosphoric acid as compared with the quantity in normal milk, since it appears probable from Dr. de Schweinitz's biochemical researches that the excess noted by the older chemists is really the result of bacterial activity in the udder of the cow.
- 7. In the meantime the pathologist has no occasion to reverse his opinion as to the identity of human and bovine tuberculosis, and the sanitarian has no reason to assume that the human subject is immune against infection with the bovine bacilli or is so slightly susceptible as to cause him to relax his efforts in preventive measures.

The writer desires to express his acknowledgments to Dr. D. E. Salmon, Chief of the Bureau of Animal Industry, U. S. Department of Agriculture, for material assistance in the preparation of this paper by placing at his disposal unpublished reports of experimental work.

Abstracts of Reports of Cases of Tuberculosis Attributed to Infected Cow's Milk.

Cases 1 to 16, 1846. Professor Klencke, in a book of ninety pages, gives the clinical histories of sixteen children who had been fed with the milk of "scrofulous-tuberculous cows," and all of these cases point to tuberculosis of either the intestines, glands, skin, or bone. In three of the intestinal disorders he refers to the presence of indurated mesenteric glands. Of these cases one died, and two at the time of the report were in a hopeless condition. The clinical histories show that four of the children had been fed with milk from Cow B, three received their supply from Cow D, four from Cow E, two

from Cow F, and three from Cow G. Professor Klencke, having connected these cases with a particular milk supply, extended his investigation into the condition of the cows—their sanitary environments—together with a chemical and microscopic examination of the milk, and actually followed up his inquiry by four autopsies of the cows, in which he demonstrated scrofulous-tuberculous lesions. Such a course is worthy of emulation, and almost complies with the conditions of proof exacted by Professor Koch. Copious abstracts of these cases were published by the writer in the report of the Health Officer, District of Columbia, 1895.

Case 17. Schoengen, to at a meeting of the Veterinary Society held at Cologne, October 18, 1873, related the history of a child who, upon the advice of the family physician, was placed on cow's milk and developed undefined symptoms suggestive of tuberculous infection. An examination of the cow by a veterinarian resulted in a diagnosis of persucht, which was confirmed by post-mortem. A change of the milk resulted in subsequent im-

provement of the child.

Cases 18 and 19. K. Leonhardt, ⁴⁶ December, 1874, reports the case of a child, previously healthy, which contracted tuberculosis soon after being weaned, and died. The autopsy revealed tuberculous meningitis and extensive lesions of the intestines and mesentric glands, which were undergoing caseous degeneration; attributed to the use of unboiled milk from a tuberculous cow.

The second case, also one of tuberculous meningitis, occurred in a previously healthy child after the consumption of milk from a cow which, upon

examination, proved to be tuberculous.

He also mentions the history of a forester's family in which the children, although previously perfectly healthy, invariably developed tuberculosis after weaning. The cow was finally slaughtered, and the autopsy revealed extensive tuberculosis. A child, born subsequently, remained perfectly

healthy.

Case 20 Professor O. Bollinger, I January 25, 1876, reports that Dr. Stang, of Amorbach, treated a boy, aged five years, well developed and of healthy parentage; no family history of tuberculosis for two generations. The child first developed symptoms of tabes mesenterica, and died some weeks later of miliary tuberculosis of the lungs, with enormous hypertrophy of the mesenteric glands, which were also undergoing caseous degeneration. While the post-mortem was being made it was ascertained that a short time previously the parents had a cow slaughtered, which was found by the veterinary surgeon at the abattoir to have phthisis pommelière. This cow had been a good milker, and for a long time the boy had been in the habit of drinking its milk, directly after the milking, in a raw state.

Case 21. Professor R. Demme, ¹⁸ 1879, reports the case of a previously healthy boy who was breast-fed until the fifth month, after which he was fed on cow's milk, and developed intestinal tuberculosis involving the mesenteric glands. The child died after three months' illness. Post-mortem examination revealed extensive tuberculosis of the intestines, especially of the jejunum and ileum and of the mesenteric glands; lungs and meninges showed no evidence of involvement. The cow died some months later, and Demme demonstrated both magrascopically and microscopically prefluctive.

Demme demonstrated, both macroscopically and microscopically, perlsucht. Cases 22 to 25. Professor Demme, 1882, reports four cases of intestinal tuberculosis which, from the family history and the clinical and pathological evidence, he attributed to infection from milk from tuberculous cows.

Case 26. Alois Epstein, ⁴⁹ 1879, reports the case of a child, three months old, in which the autopsy revealed follicular ulceration of the intestines, with involvement of the mesenteric glands and evidence of miliary tuberculosis in other organs. The author quotes Steiner and Neureiter, who in 302 tuberculous children found involvement of the lymphatic glands in 299 instances, and in 91 cases, or 30 per cent., the glands alone were involved. In 17 of 312 cases collected by Rilliet and Barthez there was no evidence of pulmonary lesions, and from this and a large amount of other evidence he

concludes that the portals of infection may be through the digestive as well

as the respiratory tract.

Case 27. Professor J. Uffelmann, 50 1880, reports the case of a child which was fed five months with milk from a certain cow. About the seventh month the child presented symptoms of bronchial catarrh and involvement of the superficial lymphatic glands. The child died at the age of cleven months with hectic fever and abdominal symptoms. No autopsy.

The cow was found to be tuberculous. The proof is not conclusive, but

Professor Uffelmann is well known as a conservative writer and teacher.

Albert Johne, 1880, reports a case in which the post-mortem examination of a cow revealed extensive tuberculous deposits in the lungs and abdominal organs, which had been sent to him for inspection by the owner, who was especially interested in the result of the investigation, on account of the fact that up to within the past few weeks the cow was one of the best-nourished animals in his stables, and the milk had been selected by the steward for his infant son. The family physician was at once notified of the results of the autopsy, and reported progressive emaciation and a pulmonary catarrh which he had attributed to a recent attack of measles. short time afterward Johne learned that the child perished from miliary tuberculosis of the brain.

Law, 51 1880, refers to a case reported to him by Dr. Corliss, of New Jersey. A family cow, supposed to be suffering from the lung plague, was found to be affected with tuberculosis instead, and the owner's wife (a consumptive), who had been making free use of the milk, warm from the cow, was persuaded to give it up and underwent decided improvement.

Cases 30 to 33. Law, 33 1883, cites two cases, daughters of a Scotch family, strong and healthy, who were brought up on milk of tuberculous cows and died of tuberculosis, while two sons in the same family who did not use the milk remained healthy. See, also, Hills and Rich in Bulletin 42, Vermont

Vet. Exper. Station, p. 55.

Mr. Howe, of North Hadley, Mass., lost a son, twenty months old, from abdominal tuberculosis three months after he paid a week's visit to his uncle and had been fed with the milk of the uncle's cow. The cow was killed soon after and proved to have generalized tuberculosis. The child's sickness and wasting began a few weeks after he returned home. He had previously been strong and healthy, as were and are his parents. (Cited by Law from Report of Vet. Congress, at Brussels, 1883, p. 288; also, by Nocard

from Compte rendu of Fourth Internat. Vet. Congress, Brussels, 1883, p. 188; and by Salmon, Bulletin No. 33, Bureau of Animal Industry, 1901, p. 21.)

Case 34. H. Meyerhoff, 1884, reports the case of a child, seven years of age, of healthy parentage and with a good family history, who developed tuberculosis after drinking for a long time milk from a cow suffering with pearl disease. Although the patient had also worn some infected clothing,

Meyerhoff attributes the infection to the milk.

Demme, 48 1886, reports the case of a boy, four months of agc, who developed tuberculosis of the mesenteric glands without the slightest lesion in the intestinal walls. The child was fed on unboiled milk from a tuberculous cow, as shown by the antopsy. Tubercle bacilli were isolated from the udder as well as from the mesenteric glands.

Among 2000 tuberculous children treated during the past twenty years at

the hospital Dr. Demme, a very conservative and competent authority, reported this and the preceding cases as milk-borne infections.

Case 36. Law, 33 1894. A child, four years old, son of Col. Beecher and a grandson of Henry Ward Beecher, died March, 1894, at Yonkers, N. Y., of tuberculous meningitis. The diagnosis was confirmed by specialists. There were no known hereditary tendencies to the disease. The certainty that he had the disease, and the inability to account for it from human agencies, led the physician to suspect the milk of two Alderncy cows, on which the child had been mainly fed. The tuberculin test and post-mortem showed that both animals were tuberculous.

Case 37. Sonntag, quoted by Baum, 69 page 196, reports the case of a child, aged six months, which died from tuberculous meningitis. The parents were perfectly healthy, but the child had been almost exclusively fed with milk from a tuberculous cow.

Case 38. Hermsdorf 96 reports the case of a girl, aged fourteen years, of good family history and healthy stock, who died from tuberculous laryngitis. The most extensive lesions were found in the ileum and cæcum. The pulmonary lesions were slight. Inquiry revealed the fact that the girl had been in the habit of drinking the milk while still warm from a tuberculous cow.

Case 39. W. P. Northrup, 37 1890, reports the case of an infant, aged fifteen months, which was brought to the New York Foundling Hospital when two hours old, placed with a wet-nurse, from whom it was taken in the twelfth month on account of its miserable condition, developed general tuberculosis,

-primary intestinal infection-possibly from food infection.

Cases 40 to 52. Ollivier, 38 1897, presented to the Paris Academy of Medicine, February 24, 1891, the history of twelve young ladies, scholars in the Pension of the Dames Blanches at Chartres, all suffering from tuberculosis, of whom five died, the last death from tuberculous meningitis. A few days later the milch cow was butchered and found to be suffering from tuberculosis of the udder and of the internal organs. In almost all of the cases there was evidence of intestinal involvement, and in none of the cases was there an inherited predisposition. Professor Koch in a recent address states that Ollivier in a subsequent communication before the Academy remarked that only the servants had consumed the milk from the tuberculous cow.

Cases 53 and 54. Professor Oscar Wyss, 39 1893, reports three cases in 123 autopsies on children, aged five and three-fourths years, six and a-half years, and two years, coming within the observation of competent clinicians during a period of three years, in which tubercle bacilli were found in the primary intestinal lesions, and all were strongly suspected of being caused by infected

cow's milk.

Case 55. Gosse, 100 1893, reports the case of his own daughter, who, up to within a year of her death, was perfectly healthy, developed tuberculosis of the intestines and mesentery, which the father traced to the consumption of raw milk from some of the cows on his own farm, which were found to react to tuberculin, and post-mortem examination revealed tuberculous lesions of the udder.

Case 56. Thomas M. Rotch and E. A. de Schweinitz, 102 1893 or 1894. The case was under the care of Dr. Rotch in the Children's Hospital in Boston in 1893 or 1894. The particulars were sent to Dr. de Schweinitz, of the Bureau of Animal Industry, by Dr. Rotch. A boy, aged seven years, had been drinking a great deal of milk from one cow for about four months before entering the hospital. The cow was found to be tuberculous, the disease being demonstrated by autopsy. The boy was a case of primary tuberculous peritonitis with effusion. Laparotomy was performed by Dr. Bradford and a large amount of serous fluid evacuated. The peritoneum was found to be thickly studded with minute tubercles, and the presence of tubercle bacilli was demonstrated. Four years after the operation the boy was found to be perfectly well, and seemed free from tuberculosis.

Cases 57 to 64. Brouardel, 106 1894 (quoted by Harrington, Practical Hygiene, 1902, page 102), records the death of seven children with no hereditary taint, inmates of a convent, from tuberculosis, supposedly induced by the use of milk from a cow with tuberculosis of the udder. Another case reported by him and quoted by Freudenreich (Les Microbes es leur des Role dans la Laiterie, Paris, 1894. p. 45) is one in which five of fourteen girls in a boarding school became infected and died. The milk which they had used daily came from a tuberculous cow. These cases and Ollivier's collection are of special value on account of the number of persons affected who have taken the same milk, the intestinal lesions, and the demonstration of tuberculous

udders.

Case 65. Law, 103 1894, reports the case of a strong, vigorous boy, aged one and a-half years, who for a week drank the milk of a cow which was

shortly afterward condemned and killed in a state of generalized tuberculosis. In six weeks the child was noticeably falling off, and in three months died, a mere skeleton, with tuberculosis of the abdomen. The father could trace no tuberculosis in his near ancestors, but the mother's father and uncle had died

of it. She, herself, was in perfect health.

Cases 66 to 68. F. A. Rich, ¹⁰¹ 1895, reports several cases: Case 1, Mr. C., a young man of healthy parents, died of tuberculosis. Three years later Rich tested the herd of cows from which the patient had used milk plentifully, destroyed sixty-five out of seventy-four, many of which proved, upon postmortem examination, to be affected with general and far-advanced tuberculosis. A few months later the owner of the herd developed acute pulmonary tuberculosis, and at the close of the report was in an advanced stage of the disease. Case 2, Mr. D., a young man, died of pulmonary tuberculosis. Two months later Rich tested the herd and destroyed eighty animals, nearly 90 per cent. of the herd. Several calves and hogs were found to be tuberculous from feeding upon the milk. Case 3, Miss R, using milk from a tuberculous cow, developed symptoms of pulmonary consumption. The cow was exchanged for another, and she apparently recovered. Three years later she went to live where the above-mentioned cow was still owned and milked, and in a short time developed acute miliary tuberculosis, from which she died a month later, and the autopsy revealed general tuberculosis.

Case 69. J. L. Smith, ¹⁰⁵ November 14, 1895, reports a case of tuberculosis in which it seemed clear that the disease had been transmitted to the little one by infected milk. The child was in charge of one of the wet-nurses of the New York Foundling Asylum, and then had been partly fed on milk from a small grocery store. Dr. R. G. Freeman found no ulceration of the intestines. The condition of the mesenteric gland, that had undergone cheesy degeneration, showed that here was the oldest lesion, and it, therefore,

indicated an intestinal infection.

Cases 70 to 81. H. C. Ernst, 59 1895. Of the 1013 replies from physicians to Ernst's questions whether they knew of cases of transmission, 895 were in the negative; 8 reported transmission from mother to child; 11 reported cases of infection through cow's milk, and 16 reported suspicious cases. Of 54 replies to the same question from veterinarians, 14 reported positive cases and 9 suspicious cases.

Case 82. M. Volkoff, 109 1895 ("Primäre Tuberkulose des Verdauungstractus," Gazetta Bolknia, 1895, No. 51, quoted in Lubarsch u. Ostertag's Ergeb. der Allg. Pathologie, 1899, p. 369), reports a case of primary tuberculosis of the intestinal tract, localized in the jejunum; from there it extended to the neighboring retroperitoneal and mesenteric glands and spleen. All other

portions of the intestinal tract were normal.

Cases 83 and 84. Von Ruck, 1899 (quoted in Dr. Salmon's Bulletin No. 33), reports two cases, father and child, which he considered almost conclusive. The former developed a case of acute miliary tuberculosis. The autopsy revealed no old focus in the chest or abdomen. The child, aged nearly one year, was first treated for fever and diarrhea, but later developed symptoms of meningitis, and died. The milk which the child had received came from a Jersey cow, and no other had been used up to the time the diet was changed on account of the diarrheal attack. The father had drunk from a pint to a quart twice a day, warm, at the time of milking, of this cow's milk. Upon post-mortem examination of the cow there was found extensive tuberculosis in the lungs and peritoneal cavity, and the lump in the udder contained a caseous centre, which, on examination, showed numerous well-stained tubercle bacilli.

Case 85. David Bovaird, Jr., 100 1891 ("A Case of Primary Intestinal Tuberculosis," Archiv. of Pediatrics, 1901, vol. xviii. p. 894), reports a case, aged three years, a patient of the New York Foundling Hospital. Family history, nothing known. No acute illness, but boy had always been weak and sickly. He was cared for outside the institution until August, 1899. The diagnosis of primary intestinal tuberculosis is based upon the autopsy findings. The oldest and most advanced lesions were in the mesenteric node.

The conclusion that the intestine has been the entry-port of the infection, Dr. Boyaird thinks can hardly be questioned. It was not possible to investigate the milk supply, but the case seemed to Dr. Boyaird to deserve to be classed as one of "Fütterungs-tuberculose."

Ebers 100 (quoted by Bovaird) reports six cases in which tuberculosis in children was attributed to the consumption of the milk of tuberculous cows. Four of these, collected by Baum, were reported by Hermsdorf, Leonhardt and Sonntag. The remaining two were reported by Johne and All but Prümer's case have already been presented in this table.

S. Delépine, 1898 ("A Lecture on Tuberculosis and the Milk Supply," Lancet, London, 1898, vol. ii. pp. 733-738), refers to Dr. Simcock's work in his laboratory, who selected thirteen cases of wasting in children, due to improper feeding, out of many more in which there was no evidence of tuberculosis in the parents or in the various organs of the children as examined in the post-mortem room. Dr. Simcock considered the cases free from tuberculosis. but Delépine was not quite convinced. On close examination of the mesenteric glands, two presented clear tuberculous lesions under the microscope and five more suggested the possibility of incipient tuberculosis.

Accidental Inoculation of Man with Bovine Bacilli (by Topical Application of Cream and Milk).

Grothan, 116 1896, reports the case of a little girl, aged six years, suffering from an eruption on the left leg, supposed to be due to ivy poisoning. This was treated at home by the topical application of fresh cream. When seen by Grothan he recognized the characteristic appearance of a tuberculous ulcer. The cow was examined and the udder seemed normal, yet inguinal and intraperitoneal inoculation of two rabbits with a mixture of milk and cream gave positive results. The caseous material from the nodules of the girl's leg injected into the peritoneum of a rabbit produced death from tuberculous peritonitis.

Coppez, 117 1896, reports the case of a girl, aged seventeen years, who had a wound on the palmar aspect of the third finger, which became infected with tubercle bacilli during milking. The original lésions gave rise to over thirty-five subcutaneous abscesses in different parts of the body within six months, and subsequently more appeared, in all sixty to sixty-six. At no time could any visceral lesions be recognized, the lymph nodes of the neck being

greatly enlarged; after several months death ensued.

Priester, 118 1896, p. 11, reports the case of a young man who tried to remove a number of tattooes from his hands and forearms by introducing milk into the tattooed parts by means of needle punctures. Later there appeared on the back of both hands at points which had been so treated bright red spots the size of millet seeds, containing a yellow center. Pus was evacuated from These were found to be lupus nodules in which giant cells several nodules. were demonstrated. The diseased parts were cut out and the wounds healed without a recurrence of the trouble.

Wound Infections.

L. Pfeiffer, 110 1885, attended, at Weimar, a veterinarian, aged thirty-four years, of good constitution and without hereditary predisposition, who, in 1885, pricked his left thumb in making an autopsy on a tuberculous cow. wound healed, but six months later the cicatrix still remained swollen, and in the autumn of 1886 the man had pulmonary tuberculosis, with bacilli in his sputa, and death occurred in two and a half years after the wound. Postmortem revealed tuberculosis of the joint of the wounded thumb, and in the lungs extensive tubercles and vomicæ. The joint lesions showed caseous masses extraordinarily rich in tubercle bacilli.

Tscherning, 112 of Copenhagen, 1888 (Proceedings of Congress for the Study of Human and Animal Tuberculosis, first session, Paris, 1888, p. 275. Cited by Law, Bujwid, 110 and Salmon), attended a veterinarian who had cut

his finger in making an autopsy on a tuberculous cow. The wound healed, but there remained a swelling which soon ulcerated and refused to heal, so that the whole tumefied mass had to be cut out. The microscope revealed a distinct tuberculous process and the presence of the characteristically staining bacilli. The patient recovered without further development of the disease.

T. A. Rich, 104 1895. (Veterinary Magazine, December, 1895, vol. xi. p. 729.) Mr. T. cut his finger on a spicula of bone while making post-mortem examination of tuberculous cows. In a few weeks he developed a tuberculous

joint and a few months later showed unmistakable signs of phthisis.

M. B. Hartzell, 111 Philadelphia (American Medical Association, June 1-4, 1897), reports a case of local infection in the back of the haud in the person of a previously healthy man employed to clean cars used for the transportation of cattle; the wound was caused by a piece of broken woodwork of a car, producing a typical verrucous tuberculosis, which appeared to yield to Within a year the patient developed pulmonary tuberculosis, and finally died from general tuberculosis.

M. P. Ravenel, 114 1897, reports the case of a veterinarian who cut the knuckle of his forefinger while making a post-mortem examination of a tuberculous cow. The wound healed badly, remained swollen, and showed a decided tendency to ulcerate. Removal of the cicatricial mass was practised and the tissues sent to Dr. Ravenel for examination. They showed typical tuber-

culous lesions with giant-cell formation.

M. T. Naughton, 115 of Chicago, Illinois, 1899 (cited by Dr. Salmon, Bulletin No. 33, p. 19), reports the case of a man, aged thirty-four years, with a good family history, a butcher by occupation, who on May 3, 1899, while cleaning cattle viscera, fell, and a meat hook upon which hearts and lungs are hung penetrated the right hand between the second and third metacarpal bones. A tendovaginitis with some lymphangitis of the arm resulted; made a good recovery; four months afterward an abscess formed in the axilla, which was cleaned, and tubercle bacilli were demonstrated in the broken-down gland tissues. In three months afterward, or seven months from the original accident, he died from pulmonary tuberculosis.

M. P. Ravenel, 114 1900, reports three cases of veterinarians in the State of Pennsylvania, of local infection from wounds in the finger inoculated accidentally with bovine tuberculosis in performing autopsies. In the first case a large giant cell but no tubercle bacilli were demonstrated in the excised portion. In the second case two guinea-pigs inoculated with a portion of the excised nodule developed a generalized tuberculosis, and in the third case Dr. John Guitéras demonstrated tubercle bacilli in the excised nodule.

Law, 113 1901 (cited by J. J. Repp. American Veterinary Review, New York, 1901 and 1902, vol. xxv. pp. 624-636), reports that a young veterinary friend, who was inoculated in the hand in opening a tuberculous cow, suffered from a tumefaction of the resulting cicatrix in which tubercle

bacilli were demonstrated.

M. P. Ravenel¹²⁹ reports the case of his assistant, who was inoculated with bovine tuberculosis, and from whose tissues tubercle bacilli were isolated after

fifty-eight days.

C. H. H. Spronk¹³³ and K. Hoefnagel, 1900 and 1901 ("Transmission al'homme, par inoculation accidentelle de la tuberculose bovine, et réinoculation experimentale au veau," La Semaine méd., Paris, Ann. 22, No. 42, October 15, pp. 341-343; abstracted from Amedicine, November 1000, 1902, p. 749), report the case of a butcher accidentally wounded, May, 1900, in the finger while assisting in inspecting the tuberculous organs of a cow. The wound healed promptly, but later the finger presented evidence of infec-In February, 1902, Professor Nareth extirpated the affected portion of the skin together with the tumefied cubital gauglia. The tuberculous character of the lesions was demonstrated by microscopic examination and by the inoculation of guinea-pigs, and an emulsion made from the spleen of one of these pigs was used to inoculate a calf previously tested with tuberculin, and the animal placed in a newly-constructed stable, with the result of producing general tuberculosis as demonstrated by the presence of giant cells and numerous tubercle bacilli. Finally two guinea-pigs which had been inocu-

lated with material obtained from this calf died of tuberculosis.

Lassar¹³³ ("Ueber Impfluberkulose," Deutsche med. Wochenschrift, No. 40, October 2, 1902, pp. 716-718) reports thirty-four cases of verrucose tuberculosis following wounds in 108,000 patients, but only four of these cases were butchers. Later he examined 365 men employed in abattoirs and found seven suffering from inoculated tuberculosis, while three others he considered as possibly affected. (This shows a percentage of two to three among men employed in the abattoirs, and only one-third of one per thousand

among persons otherwise employed.)

Hüls¹³³ ("Zur Frage der Uebertragung der Rindertuberkulose auf den Menschen, Münch. med. Wochenschrift, No. 24, June 17, 1902, pp. 1003 and 1004) reports the case of a wealthy miller's family, composed of the wife, five sons, and two daughters, herculean in stature, and boastful of strength and health. Consumption had never occurred in the family of either parent. Of these, all but two died from consumption within a few years, and even one of the surviving sons was treated for a tuberculous abscess of the finger. Hüls states that all these cases appeared subsequently to the introduction by the miller of a herd of Simmerthal cattle on his farm, which were nearly all infected with tuberculosis.

Krause¹³³ (quoted by Salmon) reports a case of a butcher, aged thirty years, with a good family history, whose duty it was to remove diseased parts of cattle killed for food. The infection was located in the right arm, and was attributed by the man to a splinter of wood run into his right thumb three years ago. Immediately after the accident he had removed the hide from Pieces of gland and skin from the arm proved on examination a sick cow.

to be tuberculous.

Troje, 137 1903, reports the case of a young, healthy male, who gave no personal or hereditary history of tuberculosis. He was inoculated with bovine tuberculosis on the hand, and a typical lupus lesion developed on the site or inoculation. Subsequently the lymphatic glands which drain the involved region became tuberculous, and in the course of time many other lymphatic glands throughout the body became similarly affected.

Recent Researches with Reference to the Communicability of Human Tuberculosis to Animals.

Chaveau's experiments (quoted by Salmon') show that cattle were successfully infected with human tuberculous material by ingestion, intravenous injection, and by subcutaneous inoculation.

Sidney Martin, 133 1895 (Report of Royal Commission Appointed to Inquire into the Effect of Food Derived from Tuberculous Animals on Human Health, London, Part I., 1895, pp. 9-11), also obtained successful results with

bovine animals by feeding sputum.

Thomassen¹³³ ("The Receptivity of Bovine Animals for the Bacillus of Human Tuberculosis," Transactions of the British Congress on Tuberculosis for Prevention of Consumption, London, July 22-26, 1901, vol. iv. pp. 21-27) reports an experiment in which a calf was inoculated in the anterior chamber of the eye with a pure culture of tubercle bacillus isolated from a case of tuberculous arthritis in man. When killed, after six weeks, both lungs were found to contain numerous miliary tubercles and some gray fibrous tubercles of larger size. The path of infection from the eye could be traced by the lymphatic glands.
Nocard, 133 1901 (Press. Vet., Angers, vol. xxi., November 30, 1901, pp. 398-

403), states that cattle are not refractory to human tuberculosis.

S. Arlong, 133 1901 ("L'inoculabilité de la tuberculose humaine et des idées de M. Robert Koch sur cette tuberculose et la tuberculose animale," Bull. acad. de méd., Paris, vol. lxv., 3 ser., xlvi., No. 43, December 24, 1901, pp. 897-911), reports experiments with three different cultures of human origin. One of these had been in his laboratory since 1896. It was capable of infecting guinea-pigs and rabbits by subcutaneous inoculations; and intravenous injection with an emulsion of this culture in a heifer calf, two sheep, and a kid conveyed the disease, as the autopsy demonstrated tuberculous lesions in all these animals.

M. P. Ravenel¹²² reports having fed four calves with human sputum, and post-mortem examination proved that all had become affected with tuberculosis, the lesions in two being quite extensive. His inoculation experiments in calves and cows with cultures obtained from the mesenteric glands of a child which died of tuberculous meningitis proved very virulent for bovine

De Jong¹³³ ("Experiences comparatives sur l'áction pathogène pour les animaux, notamment pour ceux de léspèce bovine, des bacilles tuberculeux provenant du boeuf et de l'homme ") reports a series of inoculations in seven bovine animals (calves and steers); all became tuberculous by the injection of tubercle bacilli of human origin. In one of the animals the disease was serious and extended; in four others it had a retrogressive tendency, and in two it was progressive. He concludes that bacilli isolated from the human body or from sputum are capable of causing tuberculosis in cattle.

J. Orth¹³³ ("Ueber einige Zeit-Streitfragen aus dem Gebiets der Tuberculose," Berl. klin. Woch., August 25, 1902, pp. 793-978) showed by inoculation experiments that a progressive fatal tuberculosis was produced in the animals

by material originating in the human subject.

Olof Stenström¹³³ ("Die Tuberculose des Menschen u. der Rinder," Zeitschrift f. Thiermed., Band. vi. and vii., Heft 4, 1902, pp. 289-291), from his experiments, states that he found it quite easy to infect cattle with human tuberculosis.

Max Wolff,133 1902 ("Perlsucht und menschl. Tuberkulose," Deutsche med. Woch., 28 Jahr., No. 32, August 7, 1902, pp. 566-570), reports inoculation from cases of primary tuberculosis of the intestines in man, from which he

concludes that pearl disease of cattle may appear in man.

Johannes Fibiger and C. O. Jensen, 133 1902 ("Ucbertragung der Tuberculose des Menschen auf das Rinder," Berl. klin. Woch., 39 Jahr., No. 38, September 28 1909 and 881 886) appellede het tetting that Woch appeared that tember 22, 1902, pp. 881-886), conclude by stating that Koch announced that one could distinguish between human and bovinc tuberculosis by inoculating calves subcutaneously. If this is true, then they are of the opinion that three of the calves cited in their experiments must be considered as perlsucht, and the idea that tuberculosis of cattle is not virulent for man is disapproved.

Dean and Todd, 133 1902 ("Abstract of Certain Experiments on Tuberculosis," Lancet, London, November 1, 1902, pp. 1186, 1187), from their experiments conclude that the human tubercle bacillus is by no means innocuous to the calf, as the control animal injected directly with sputum contracted an

extensive glandular tuberculosis.

E. v. Behring, 188 P. Romer and G. Ruppel (Tuberculose, xviii. p. 90, Marburg, 1902) report experiments in which human sputum was used to inoculate a guinea-pig, and a culture from this animal's spleen was used for inoculating a goat, and an emulsion of the spleen of the goat was passed through a series of guinea pigs, and a culture obtained from the spleen of the third guinea-pig was inoculated into a calf by intravenous injections. The calf died after four weeks directly from the tuberculosis thus produced. A cow was also inoculated November 26, 1901, with a tuberculous culture of human origin after a single passage through a gninea-pig, and on January 14, 1900, the affected eye was enucleated and a pure culture was obtained from it after one passage through a guinea-pig. The cow at the close

of the report was gradually losing ground.

De Schweinitz's recent experiments with intravenous injections and inoculations of cultures obtained from the mesenteric glands of children affected with tuberculous peritonitis produced fatal generalized tuberculosis in calves, and a steer inoculated subcutaneously with a piece of tuberculous

tissue from one of the children also produced tuberculosis.

Mohler's 233 experiments also show "that it is not a difficult matter to

obtain very virulent tubercle bacilli from human sources, and that some of

these are just as virulent as bovine bacilli."

A. Cipollina¹³⁵ reports that a monkey fed with bovine milk containing tubercle bacilli cultures contracted tuberculosis, with no primary lesions apparent in the gastrointestinal tract. On the other hand, inoculation of a calf with human bacilli resulted negatively.

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TABES IN THE NEGRO.*

BY D'ORSAY HECHT, M.D.,

INSTRUCTOR IN NEUROLOGY, NORTHWESTERN UNIVERSITY MEDICAL SCHOOL, CHICAGO.

About the negro much has been set down in the annals of anthropology, ethnology, and sociology, and a glance at medical literature as it appears in summary form from year to year would suggest that almost the last word has been written about tabes; but of tabes in the negro I have been able to obtain only the fewest references recorded, in the main, by American writers. Von Leyden¹ quotes Buri as sponsor for the statement, "bei den so häufig syphilitischen Negern soll die Tabes sehr sellen vorkommen" (tabes occurs very rarely in the large number of syphilitie negroes). In another foreign contribution to the literature of this subject, entitled "La Ataxia Locomotriz (en el negro)," is recorded the fact of tabes occurring eight times in full-blooded negroes and three times in mulattoes.

C. W. Burr³ in a report on "The Frequency of Loeomotor Ataxia in Negroes," read before the Philadelphia Neurological Society, 1892, prefaces the comments on his own case with the written opinious of many Southern practitioners, all of whom were unanimous in declaring tabes in the negro of rare occurrence. Professor Osler is also quoted, in answer to Dr. Burr's query, as stating "of twenty cases under

^{*} Read at the meeting of the Chicago Nenrological Society, October, 1903.

observation since the opening of Johns Hopkins Hospital, one was a full-blooded negro and one a mulatto." Dr. Potts, physician to the Nervous Dispensary of the University of Pennsylvania, told Dr. Burr that he had not seen a case in eight years. During fourteen years, says Dr. Burr, not a case applied at the Infirmary for Nervous Diseases in Philadelphia. He adds: "For my own part, I have never seen a case in the pure black, and but one in a mulatto." McConnell' presented a report of five cases before the Philadelphia Neurological Society in 1899, in which he stated that he had seen "tabes in many whites, a few cases among the mixed races, and but five instances in pure negroes." Four of these cases were in males and one in a female. Dr. J. H. Lloyd, in 1896, reported one case in a negress. In a tabulation of 194 cases of tabes, with a view to demonstrating the distribution among the different nationalities, F. Savary Pearce gives the following:

But .	American and	Engl	lish						119
المصورين	French . German .								2
	German .			•					21
S. 35 -	Hebrew .		•		•				6
2002	Irish								25
El lille	Colored (not p	ure)		•					2

The next reference in American literature, and one of more recent date, is that of A. P. Francine, who discusses briefly "Two Cases of Tabes Dorsalis in Negroes—Husband and Wife." In this article S. Weir Mitchell is credited with saying that he has seen four cases of tabes, two of which had occurred in mulattoes in Florida.

Aside from these allusions in the literature to the subject-matter of this paper, it has become, I believe, almost a habit with clinicians to regard the colored people as exempt from this disease. Neurologists as well, who from year to year attract an ever-increasing, vast clinical material, confess to having seen little or no tabes in the negro. My chiefs in the Department of Nervous Diseases at the Northwestern University Medical School, Professors Hugh T. Patrick and Archibald Church, record having met with three cases each in their entire experience.

It has been my good fortune during the past year to see and study four undoubted cases of tabes in colored individuals, three of them being in females and one in a male. Although adjudged in the light of sheer coincidence, this ratio of three to one in favor of the female is unusual, since statistical plurality is quite the other way. The clinical picture in these cases in no way deflects from the symptom-complex we are accustomed to see in the whites except, perhaps, in the fact that they are all of the "amaurotic type" of the disease. Satisfied on the score that there is nothing of a pathological nature to reveal, I am, nevertheless, mindful of other points of interest which I believe should

command the attention of medical men, and neurologists in particular, and for the following reasons:

- 1. The relative vital movement of different races in a mixed population is a matter of interest to the physician as well as the ethnologist.
- 2. The white and colored races living side by side in this country and in some of the Southern States in nearly equal numbers afford an opportunity for study, though the problem is rendered complicated yet interesting by their partial admixture.
- 3. The compilations and statistics in the past on "race and disease" have slighted certain diseases of which we are in duty bound to know more than we do, in order to avert inadequate and incomprehensive conclusions.
- 4. Tabes in the pure and hybrid negro should afford fresh incentive for a study and investigation of the, in large part accepted, in part conflicting, and in part rejected, evidence of a luetic etiology.
- 5. The influence of race amalgamation on production and inhibition of disease (with special reference to civilization and syphilization as a factor in the production of tabes) is important in all lands.

To quote from that brilliant and exhaustive treatise, "The Surgical Peculiarities of the Negro," written by Dr. Rudolph Matas, of New Orleans, and delivered at the 1896 meeting of the American Surgical Association, "the influence of crossing and a comparative study of the negro is a prerequisite to the understanding of medical shades of difference."

These questions can only be approached by a better understanding of the vicissitudes through which the negro has passed since the days of his importation from Africa, but an historical commentary treating of the native African negro would far exceed the intended scope of this paper. Concerning negroid ancestry in Africa, I might say that valuable accounts of the endemic diseases afflicting the negroes who live in semisavage or tribal state in Africa appeared in 1895 in communications to the German Government by Dr. A. Plehn. He dwells at length upon all the diseases to which the negro is prone, briefly classifying the nervous diseases as follows:

"Beriberi prevails in Kamerun, but perhaps to a greater degree in Sierra Leone and Congo. I have seen a single case of hysteria (cinen ausgesprochenen Fall), with all its signs and symptoms, in the wife of King Bell. Epilepsy occurs; I recall four cases (ausgeprägte Fälle) in Kamerun." This exhausts his list.

When the negro was first imported he brought with him diseases peculiar to himself (sui generis) and foreign to the inhabitants of our colonies; yaws—the sleeping sickness—and elephantiasis belonged prominently to the earlier era in this country. A study of these and other diseases was immediately begun by Southern practitioners, and

the numerous authentic works extant as classics bear witness to the untiring effort and careful observation made by the Southern profession. The names of Nott (physician and anthropologist), Gliddon, Cartwright, Grier, Corson, and Tipton are inseparably linked with the literature exploited in the Southern medical journals as far back as 1850. Trismus nascentium—marasmus—referred to by Grier as "literally a wasting away—a tabes of young life—provincially styled 'the drooping disease of negro children,'" invermination—cachexia Africana—(dirt-eating disease of the negro) are familiar topics in the pioneer literature of the South. Grier, in 1852, said: "Whether the races be derived from one or more original species, they are now characterized by such peculiarities of constitution and temperament as to make the distinctive maladies of the negro race a subject of much practical importance to us and worthy of a more painstaking investigation than it has ever yet received from the hands of the medical profession of the South."

According to the consensus of medical and statistical opinion, release from bondage has been the turning-point in the negro's physical welfare. Such medical writers as Tipton, Furniss, and principally Corson and Matas, pronounce this as the beginning of his downfall, his physical deterioration and moral degradation. Since the war and cmancipation the avenues of independent occupation have been flung wide open to irresponsible beings, unprepared for their unequal lot. The introduction of civilized vices into uncivilized communities began anew, and the negro was quick to accept and devour the vices and excesses of material civilization. Out of the general morbidity and depravity of this new community of interests sprang a mortality record which was immediately higher than that of the whites in ante-emancipatory times and has been getting increasingly greater in later years, until now the nation feels a keen concern in the gravity of the "vital statistics of the negro."

Diseases incident to the state of slavery are disappearing, and tuberculosis, syphilis, and cancer are deep-rooted in the colored people. Old immunities are lost. Admixture with white blood has weakened the race. In the presence of new blood has come the tendency to acquire new diseases; the amalgamation is responsible for much that is radically new in the pathological field.

By a legitimate intermingling of tribal strains of blood originally distinct in Africa and an illegitimate, universal miscegenation with the whites, the typical American negro of to-day has incorporated in his formation certain generic characteristics of his negroid ancestry plus the deteriorating phenomena of his hybridity.

CASE HISTORIES. Whereas, the cases I am about to report do not present in number or variety the symptoms we are accustomed to asso-

ciate with this essentially ehronic disease of the nervous system as it occurs in the whites, nevertheless, the clinical syndrome in each ease precludes the serious consideration of any other disease. The eases tabulated here were seen in Dr. H. T. Patrick's elinic, Northwestern University Medical School.

Case I. (Referred from Eye Department, Northwestern University Medical School, by the courtesy of Dr. Richard S. Patillo, who anticipated the possible diagnosis of tabes fom the "fundus" findings.)—February 4, 1903, M. R., aged thirty-nine years, female, colored, married. Born in Louisville, Ky., of black father (slave) and bronze mother (slave). The father lived to grow very old at the Soldiers' Home, Wyandotte, Kansas; cause of his death unknown. Mother lived to the age of sixty-five years and died of some asthmatic trouble.

The patient, as a young girl of twelve years and upward, was subjeeted to exposures of wet and cold, which led to the development of rheumatic symptoms that have prevailed from year to year with moderate severity. The hardest of work was required of her in an attempt to support the family. One brother died of smallpox at the age of twenty-three years, and one sister died of pneumonia at eighteen years. At the age of sixteen years the patient miscarried an illegitimate child at four months. She attributes this occurrence to a fall which she experienced at the time. At eighteen years she married the father of her first illegitimate, and gave birth to a full-term, living male child in the first year of her marriage. Prior to the birth of the child she records having had a protracted siege of sore throat, and adds that the husband abandoned her, with the excuse that he was afraid of giving her some "bad disease." She denies knowledge of specific taint, and upon inquiry records no signs of secondaries. I detail the data of ancestry and venereal infection, holding them to be particularly important in the anamnesis of these cases. At the age of eighteen years she had what she pleases to call an attack of pneumonia, but since that time and up to the date of onset of the present trouble she has had "no misery nor corruption anywhere."

Present Illness. Onset about five years ago, with severe headaches persisting for a week at a time, disappearing and recurring for longer or shorter intervals. Headaches agonizing, occipital, vesperal. Simultaneously, dimness of vision in left eye, which glasses did not seem to relieve. Failing vision progressive until two months ago, when she noticed complete blindness in the left eye. Sight in the right eye began to fail shortly before the vision in the left eye was destroyed, and is becoming more and more impaired. Early in the course of the trouble patient experienced severe paroxysmal pains in the stomach, coming on once or twice a week, more often at night, localizing with greatest intensity at the navel. Describes sensation of a rope tied with increasing tightness around her middle. Refers to leg pains as boring and gnawing in character, beginning at the ankles, ascending to the knee and fleshy part of thigh. Sense of tingling and of "things crawling" on the soles of the feet. Of incoordination it may be said that the patient is occasionally inclined to stumble or stub her toe against the floor, especially at times when she feels nervous. Frequently finds it necessary to hurry to the toilet when she least expects it, for fear of

soiling her clothes. Despite the good appetite which she enjoys, she has lost about twenty-five pounds in weight during the past year. (This fact, together with that of a temperature of 100.5° F., led me to suspect a tuberculous focus, which the physical examination revealed as present in the left apex of the lung.) Bowels constipated; sleeps fairly well; says she is more concerned about her eyes than all the other symptoms.

Status Præsens. In general appearance of average height and fair nutrition; bronze-skinned; mouth and pharynx negative for post-specific scars; heart negative; no peripheral arteriosclerosis; pulse regular and full; lungs give evidence of left apical tuberculosis; urine negative; glandular system, isolated enlarged glands, especially inguinal. No bony deformities. Sexual instinct not so keen for past

five years—has had "little nature for a man."

Sensations. Subjective: Tingling and formication on plantar surfaces of feet. Objective: (1) Tactile sensibility everywhere acute; (2) well-defined analgesia, both legs from knees down; (3) trunk anæsthesia absent; (4) ulnar analgesia slight. No trunk anæsthesia. No persistence of painful impressions. No delayed conduction of sensory impressions.

Sphincters. Slight incontinentia urinæ.

Coordination. Virtually unimpaired; no ataxia of gait; no ataxia of station except when put to the test of balancing on one foot. Finer tests, such as heel to knee and finger movements, show slight degree. Tremors absent.

Reflexes. Patellars bilaterally absent; Achilles, bilaterally absent; plantars exaggerated; abdominal, upper and middle zones brisk;

Babinski absent; wrist absent.

The Eyes. I am indebted to Dr. Richard S. Patillo for the report of the eye finding, as follows: Total iridoplegia; no oculoplegia. Visual field with "white," one-half inch square; above, two inches; nasal side, two inches; temporal, one inch; lower, three inches; apparently no scotoma. Ocular tension normal. Double optic atrophy. Acuty of vision, O. D. $\frac{20}{200}$; O. S. $\frac{90}{60}$.

Case II.—L. M., aged forty-six years, female, colored, married; color

light bronze. The ancestry of this patient is as follows:

Paternal grandfather, full-blooded Indian; paternal grandmother, full-blooded negress; maternal grandfather, full-blooded negro; maternal grandmother, Irish. Thus these strains make this woman one-half negro, one-quarter Indian, one-quarter Irish. Patient born in Ricetown, Maryland, and reared in Baltimore. Parents were free when

patient was born.

Of past illnesses, patient records croup and measles when a child, and typhoid fever at sixteen years. Married first at age of nineteen years to a full-blooded negro. Four years married, when she miscarried at two months—no ascertainable cause. First husband died. Married again at age of thirty years, also to a full-blooded negro; second marriage childless. Has no knowledge of a luetic infection. She does, however, state that after the first year of married life, that is, at the age of twenty years, she experienced severe "sick" headaches, coming on with increasing frequency at any time of the day, locating with greatest intensity over the right eye, and again over the left, and accompanied by a sense of nausea, which would occasionally end in vomiting.

Present Illness. Began in 1895, with severe throbbing pains in the legs, neuralgic, as she calls them, and along the nerves, radiating from the thigh downward into the calves. Vision began to fail in 1896. She at that time was under treatment at the Illinois Eye and Ear Infirmary, and was referred by the oculist to Dr. Patrick, who saw her for the first time at the Polyclinic in that same year, and made a diagnosis of tabes. Sight in the left eye was completely lost within six months from the date of onset. At this time incoordination was not very marked. The right eye began to fail her soon after the left, but for the past four years vision has remained stationary. She claims that she can see the daylight out of the corner of the left eye (mental); with the right eye she can distinguish daylight from lamplight or differentiate a bright from a dark day, but she cannot see to read—in other words, she has only "quantitative vision."

Status Præsens. In appearance is fairly well nourished; of bronze complexion; mouth and pharynx normal; thoracic viscera normal;

urine negative; sexual instinct indifferent.

Sensations. Subjective: Early in the disease as of "cold water running under the skin," but of late this has disappeared. Objective: (1) Tactile sensibility everywhere most acute; (2) analgesia in the limbs, slight from the thigh to the knee, but very marked from the knees downward; (3) trunk anæsthesia absent; (4) ulnar analgesia present.

Reflexes. Patellar: Left abolished, right very faint response with reinforcement; plantar reflexes normal; Babinski absent; wrist taps

present; abdominal and skin reflexes present to slight degree.

The Eyes. I am obligated to Dr. Salinger for the eyc-findings in this case. Quantitative vision only. Total iridoplegia, both disks graywhite and excavated; double optic atrophy. No ocular paralysis.

Coordination. Gait unimpaired; no static ataxia; slight ataxia to

finger movements. Sphineters: Slight retentio urina.

CASE III.—W. F. P., male, black-bronze in complexion, aged fortynine years, married these ten years—childless marriage. By occupation a waiter. I was unable to ascertain so exact an heredity as in the previous cases. I did determine, however, that the father died an old man from some kidney disease. The mother is living and well, as are two sisters and one brother.

The patient had measles as a child. States that he had gonorrhea as many as five or six times, the last attack eight years ago. No history of chancre. He has been temperate in his habits, drinking beer moderately, and does not deny taking an occasional whiskey, as he says, to stimulate him since his present nervous trouble has come on. As to injuries, he presents a scar over the left temporoparietal region, which he states is the result of a lacerated wound of the scalp received some twelve years ago from a glass of water thrown at his head.

Present Illness. Onset about four years ago, with dizziness, especially distressing when the patient got out of bed in the morning, and which in a short time reached such an alarming degree as to make his efforts at walking for the first two or three hours of the day almost impossible. In his own words, he could never "gather himself together until about noontime." (I believe that this dizziness is to be regarded more in the light of incoordination than vertigo.) He says that frequently his swaying from side to side was so great as to give onlookers the impression that he had been drinking. During the latter half of the day he

grew steadier on his feet and kept so until the following morning, when the evidences of his incoordination promptly reappeared. A loss of memory has been a conspicuous feature in this patient's case from the very first. Being a waiter by occupation, he found himself greatly handicapped by his poor memory in receiving and remembering orders given him. He would forget parts of an order, and lately he has taken an order as far as the kitchen only to return and ask the customer to repeat same, as he had entirely forgotten it. About one year after the ouset of this dizziness and impairment of memory his eyesight began to fail him-three years ago. With this failure of vision there has come a sense of fear when the patient is abroad (born of his ataxia), having fallen time and again over such objects as chairs and other obstacles that seemed to have been in his way. As he puts it, he has "lost his nerve." For the past seven months he cannot see well enough to read print. Fulgurant pains radiating from the thighs into the calves have been present for the past two and one-half years. The patient has regarded these as rheumatic. In addition, he complains of a sense of tightness at the waist, which impression he, of his own accord, chooses to disabuse me of by saying that his trousers are far too large at the waistband to account for this feeling. There can be no doubt that this sense of constriction is none other than a "girdle sensation." Sexual power is weakened to a degree of partial impotence. Has lost appreciably in weight, despite his good appetite. Bowels constipated.

Status Præsens. General appearance that of a man in good nutrition; weight, 145 pounds; height, 5 feet 1 inch. Heart and lungs are normal; no vasomotor disturbance; no peripheral vascular changes.

Sensations. Subjective: Soreness and a sense of burning on the soles of the feet. Says that at times he feels as though he were walking on a gravel path. Objective sensations, negative.

Coordination impaired, but only slightly; most manifest when told to turn quickly or suddenly rise from his chair. Not at all present during his more deliberate movements. Romberg sign absent. Slight tremor (coarse) in the right hand upon protrusion.

Reflexes. Left patellar brisk; the right almost abolished. Contrastingly, the left Achilles is abolished and the right Achilles is faintly present with reinforcement. The abdominal skin reflexes are everywhere brisk.

Eyes. (Examination by Dr. R. S. Patillo.) Pupils equal in size, the left slightly irregular in outline. Right pupil reacts to light sluggishly; left pupil does not, but both react to accommodation. Fundus: Optic atrophy in both eyes. Acuity of vision: O. D. $\frac{8}{120}$; O. S. $\frac{0.0}{0.0}$; ocular tension normal, no oculoplegia.

Organs of special sense uninvolved. Tongue shows neither deviation

Referring once more to this patient's complaint of dizziness, I do not wish to insist that the patient could not have been suffering from a genuine vertigo in the incipient stage of the disease, because it may be and sometimes is a feature in some cases, but is of distinctly inferior importance and occupies a low place in the scale of conspicuous symptoms. Bonar¹¹ in 286 cases found it in 0.34 per cent. Another rare symptom presenting in this case is that of tremor, which Bonar¹¹ found in 1.74 per cent. of his 286 cases.

CASE IV. (in brief).—S. M., female, aged forty years, light brown in complexion (lightest in complexion of all the cases), born of black mother and white father; married and has one living child, prior to the birth of which the patient had two miscarriages, without ascertainable cause. Seamstress by trade. Knows nothing of father; mother living, but patient does not know where. Has one brother and two sisters, all of whom are even lighter in complexion than she is.

Patient had typhoid fever at the age of eighteen years; also vaguely refers to fever and chills. Onset of present illness six years ago, with severe headaches and excessive nervousness. Inquiry as to this nervousness elicited the fact that she had difficulty in threading her needle, although she could see the eye of the needle as plainly as ever before. There were days when she was not annoyed by this symptom, and then for weeks at a time the symptom would reappear. using the machine her line of stitching was anything but straight at times, and her limbs easily gave out in the act of treading. The symptoms continued until she was forced to give up this kind of work. the third year of her trouble, eye symptoms developed and for a short period of time prior to the beginning failure she saw things double (diplopia). Bladder disturbance manifested itself about this time. She gives no evidence of disturbance of gait or of severe lancinating pains. She is more worried about her eyesight than anything else, and deplores her inability to resume work as a seamstress. Her symptoms have not taken on an increasingly aggravated form for the past three Denies venereal infection.

Status Præsens. A female of slight build, about 110 pounds in weight, and taller than the average woman. Yellow skin; somewhat emaciated in appearance; heart and lungs normal. Urine negative.

Sensations. Subjective: Cramp-like pains in the calves, paroxysmal,

but not severe. Objective: Analgesia most marked on the dorsal aspect of the feet.

Coordination disturbed and easily detected upon an attempt at finer movements; cannot approximate index fingers well, nor can she grasp small objects without very apparent awkwardness. No ataxia of station except when standing on either foot alone. Gait normal. Hands, more especially the fingers, tremulous upon protrusion.

Reflexes. Both patellars completely absent. Achilles both absent. Abdominal reflexes and skin reflexes faint in their response. Babinski

reflex absent.

Pupils equal in size and regular in outline. The irides The Eyes. Fundus: Partial optic atrophy do not react except to accommodation. in both eyes. No ocular paralysis.

Complains of deafness in left ear, which, however, she says is not

constant.

I hold it would be erroneous to attach undue importance to the conclusions that accrue from an analysis of so few cases, but that fact should not deter from bringing out and emphasizing points of difference and similarity in the disease as it affects another race than the Cau-In the matter of sex the most recent and conservative figures imply a proclivity for this disease in the Caucasian male, and it is a matter of no little interest that in the colored race, respecting my four isolated cases, the frequency is quite the other way. As to the age at which the disease manifests itself in these cases, it concurs with the statistics that have placed more than 50 per cent. as occurring in the third decade.

The ocular phenomena in this series merit special attention. One of the cardinal symptoms of tabes lies in the condition of the pupils. Argyll-Robertson pupil was present bilaterally in three of the cases, and in the fourth was found in the left eye, there having been a sluggish reaction to light in the right. The intense pigment in the eye of a colored individual renders a decision as to the presence of a pupillary reaction and its degree of prominence much more difficult than in the eye of a white person. The pupils in all but one case were equal in size and regular in outline. Schaffer,14 is authority for a remark made by Gowers that the Argyll-Robertson pupil is only present in those cases of tabes which are of undoubted luetic origin. I am not aware that other clinicians coincide with this statement. The failure of vision occurring in all the cases, revealing for its cause the presence of optic atrophy in all of the eyes, led me to look into the question, and I found that relative to the statistics of optic atrophy in tabes as it afflicts the whites there is great variation. Von Grosz¹⁵ found it present in 88 per cent. of his cases; Berger, 15 in 46 per cent.; Dillman, 17 in 42 per cent.; Marina, is in 12 per cent.; Bernhardt, is in 10.3 per cent.; Thomas, 10 per cent.; Leimbach, in 6.75 per cent. Bonar's figures of 8.74 per cent. are based upon an exhaustive and critical analysis of 286 cases of tabes from the case records of Allen M. Starr's service at the Vanderbilt Clinic, New York. Bonar states that optic atrophy was either well established or beginning in 25 cases, "and," he adds, "one case was that of a colored man in whom the atrophy came on as the first and only symptom except the blindness caused by it and the absence of the knee-jerks." The well-known fact that cases of profound tabes so often come under the care of the oculist for disturbances of vision, and are by him referred for a wider interpretation to the neurologist, led me to investigate ophthalmological statistics for data as to the comparative prevalence of optic atrophy among the whites and blacks.

In the Archives of Ophthalmology, 1884, Swan Burnett's²¹ treatise on the "Comparative Frequency of Eye Disease in the White and Colored Races of the United States" included a consideration of the diseases of the optic nerve, retina, and glaucoma. His statistics comprehend a consideration of 2325 cases, of which 1514 were colored and 811 were whites, and all of which were by him personally examined and observed. He subdivides his cases into diseases of the conjunctiva, diseases of the cornea, diseases of the iris and choroid, etc., diseases of the optic nerve, retina, etc., as follows:

DISEASES OF THE OPTIC NERVE, RETINA; GLAUCOMA. (SWAN BURNETT.)

				White.	Colored.
Atrophy of optic nerve				. 14	13
Retinitis albuminurica				. 2	5
Amaurosis				. 1	7
Retinitis sympathetica					1
" specifica .				. 3	3
" pigmentosa .				. 1	2
Neuroretinitis					3
Myxoma, optic nerve				. 1	•••
Glaucoma, simple .				. 4	14
" inflammatory				. 1	2
" secondary.					1
Hyperæmia retina .				. 2	2
Glioma retina					1
Detachment				. 2	•••
				31	54

He fails to comment upon the finding of optic atrophy as a symptom of tabes—in fact, he does not discuss the matter at all. It would be interesting to know what other oculists have to report in this connection.

The cases reported by McConnell²² in 1899, instances of tabes in the full-blooded negro (according to the author), were of the amaurotic typc. In his cases, as well as in mine, all the symptoms, some of which had attained an aggravated degree, were held in abeyance as soon as the optic atrophy had manifested itself. Benedickt²³ goes so far as to say that he had never known an exception to this condition, and Bonar, ²⁴ relative to his twenty-five cases, in which the atrophy dominated the other symptoms, says: "Where the first symptom was the blindness due to optic atrophy there has been no further advance of the disease."

Abeyance of all other symptoms naturally includes an arrest of incoordination, which actually occurs. It is a rare thing for a man with tabes to have marked incoordination and almost total blindness -one or the other may be conspicuous, but seldom, if ever, coexistent. As Dr. H. T. Patrick,25 in a clinical lecture on "Locomotor Ataxia," says: "This is not a trivial matter, because one patient consulting us for trouble with his legs may know another patient with locomotor ataxia who has become blind, and vice versa, and he is greatly worried for fear he may acquire the same symptom. If a patient comes to you with failure of vision from locomotor ataxia, you are justified in assuring that patient that he will always have good use of his lcgs." Just why this is so has been for years a matter of conjecture. McConnell presented his five cases before the Neurological Society of Philadelphia, in 1899, emphasizing the abcyance of ataxia in the presence of the optic atrophy, it was suggested in the discussion to invoke the Edinger compensation theory (Ersatz theorie) in explanation of this conciliatory effort on the part of the damaged nervous system. Dr. Spiller, in the discussion, stated that he had entered into an interesting correspondence with Edinger on this point, and could quote a passage from his (Edinger's) letter, which read to the effect that the substitution theory did not supply all the needs in the cases to which it applied.

For those less familiar with the Edinger hypothesis, published in 1894, I have given a succinct interpretation of the principles therein involved.*

* Edinger's theory is based upon the time-honored physiological dictum which was original with Weigert, and states that the usage and function of a part implies disintegration and consumption of some of the active tissue. In this sense it has been applied to the nervous system by Edinger, who furthermore assumes that where nutrition in a part is deficient (or even under normal conditions) and the cells are called upon to do excessive work, suprafunction, thus disturbing the balance between combustion and repair, the developmental energy in the resting tissue will serve to bring about a degeneration of the less resistant active parts.

In order that the Weigert-Edlnger view as it pertains to both motor and sensory spheres of the nervous system succeed it is essential that it be proved that certain tracts under normal conditions are called upon to perform more work than others, and that these overworked tracts undergo correspondingly pronounced degrees of degeneration. Edinger regards as a prerequisite to the decline a disturbance of general metabolism and a deficient nutrition.

It is observed by Edinger that the sensory nerves, for instance, are constantly transmitting sensations from the skin to the central nervous system; the fact that we are unconscious of the presence of a sensory mechanism does not mean that we are not possessed of one in constant operation, for we are, and the sensory nerves are the very ones, for that reason, to suffer.

From these hypothetical premises are argued the production of the clinical sensory symptoms—anæsthesias, paræsthesias, hyperæsthesias, etc. The sensory disturbances evidence themselves, as might be expected, in those areas on the body where the peripheral nerves are most irritated from contact, for instance, with or pressure of the wearing apparel. Corroborative of this reasoning, there are found in tabes irregular and scattered patches of anæsthesia occurring frequently on the soles of the feet and in a narrow band encircling the waist. This ingenious reasoning Edinger applies to the eyes, more especially to the nerves of the "constrictor iris." since there can be no glance at any object, no matter how momentary, without this muscle and its nerve supply coming into play. The light reflex is almost constantly active, in contrast to which the accommodative reflex is but seldom so.

Reverting once more to the physiological principle, we might expect a degeneration of the fibres controlling the reflex arc to light, while the latter, those governing accommodation, remain normal. In this way the author of the theory chooses to explain the clinical phenomena known as the Argyll-Robertson pupil, optic atrophy, oculoplegias, and especially ptosis. The disturbance in function of bladder and rectum arc alluded to in the same sense.

Edinger has drawn a parallel between the above symptoms ascribed to suprafunction in an ill-nourished nervous economy and those which complete the typical picture of takes, viz., the incoordination, lost knee reflexes, Argyll-Robertson pupil, oculoplegias, optic atrophy, and loss of sphincter control.

If his deductions are correct, the theory supplies a more satisfactory explanation of the pathology of tabes than any as yet offered, and better accounts for the presence of many hitherto less well understood but widely recognized clinical phenomena.

Profound study of the hypothesis thus far constructed led Edinger to carry on experiments in furtherance of the truth of his ideas. He followed in the footsteps of Voss, who produced extreme malnutrition in animals by the use of substances (pyrodin) which impaired the blood-making powers, and then subjected them to forced activities. Animals so treated showed upon post-mortem examination degenerations closely resembling those of tabes in the motor tracts of the cord.

By inference, then, it is clear that Edinger's theory postulates (1) the deleterious effect of noxious agents on the nutritional state of the nervous system; (2) a nervous soil so prepared is further agitated by normal or excessive function until a symptom-complex results, such as we are, for instance, familiar with in takes.

The theory met with an objection at the hands of Schultze, who argued that if function determined the localization of the disease there would be every reason to note degeneration in the motor nerves and anterior cells, with occurrence of paralysis and muscular atrophy. This objection was overruled by Edinger with the assertlon that the motor nerves were ana-

That the Edinger theory as it applies to both motor and sensory spheres of the nervous system sueeeed it is essential that it be proved that certain tracts under normal conditions are called upon to perform more work than others, and that under the influence of undue stress in the form of overwork, either relative or absolute, these tracts degenerate, this degeneration being associated with a disturbance of general metabolism plus deficient nutrition. In other words, given a man who is drenched with substances of noxious character, toxins, if you will; acknowledge that his entire economy has undergone a metabolic change as a result of their influence, and let him use to excess such faculties or functions as involve certain tracts at the expense of others, and there the deficit is most felt, and there the degeneration is most evident. People who use their lower extremities most are prone to suffer from ataxia in the legs; people using their eyes most have to contend with optic atrophy. In the course of human events it would be ridiculous to aver that the negro uses his eyes at the expense of his legs or other organs; in fact, it is perfectly right to assume that he uses them far Here we encounter a weak point in the Edinger hypothesis. Edinger himself, true and fair-minded scientist that he is, aeknowledges the fallibility in part of his reasoning when he states that his theory may not eover all the needs of a ease. There is an experimental groundwork for the substantiation of Edinger's theory, even though the elinieal data are not always corroborative. These experiments are highly

tomically safeguarded with a greater power of resistance and a better supply of nourishment than the sensory.

With an acceptance of the Edinger theory much that is vague and indefinite as to the tabessyphilis question becomes satisfactorily explainable. The normal relation between waste and repair is influenced by the noxious action of syphilis on all the tissues of the hody and further impaired by the coincident vascular changes of the disease.

Acknowledging the high percentage of tabetics who are known syphilities, one is enabled to account for those cases which give neither the history of specific infection nor somatic evidence thereof. By this token we are not called upon to believe that everyone who has tabes must have had syphilis—a fact insisted upon by some authors, but still unproved by reliable statistics.

Edinger has provided a unitary etiological factor for the disease tabes in that syphilis, exposure to cold, wetting, trauma, excesses in "Baccho et venere" are grouped as predisposing noxious features disturbing the nutrition of the nervous apparatus, the associated undue stress of function completing the requirements of the clinical picture.

Even the clinical symptoms bear out the theory: the lower extremities are affected first in a majority of the cases, and in the few cases of tabes high up in the cord, the cervical type or the tabes cerebrale of the French, the information was elicited by Edinger that the arms had been called upon to do proportionally more work, and that these patients were by occupation seamstresses, carpenters.

The sex ratio as variously established, from 15 or 3:1 in favor of the men, fits well with the theory, since men engage in physical pursuits.

In referring to the pathological process and its limitation to the intrameduliary distribution of the sensory neuron and not its peripheral part, which is virtually exposed to the same stress, Edinger explains that (1) the peripheral nerves enjoy the protection of an additional sheath; (2) the least resistant point of the neuron, owing to a constriction of the myelin sheath (or its absence), is at its point of entrance into the cord.

As for a consideration of the therapeutics applied in consonance with this theory, suggestions have been made in the body of this paper.

instructive. By feeding rats pyrodin he caused a profound intoxication and anæmia, after which they were made to indulge in great activities of a certain kind, and it was found that those rats that had been put hard at work showed, post-mortem, a correspondingly advanced grade of spinal-cord degeneration. This discovery led Edinger into the field of therapeutics with a suggestion in prophylaxis, "insisting that exertion and fatigue of any sort should be avoided," maintaining further that, "in a large number of cases treated for a number of years on this basis, results have been obtained in the way of retarding the progressive development of the disease." The proportion of males over females he attributes to this same pernicious effect of overactivity.

I deem it expedient at this point to introduce evidence of very recent date and from a most reliable source, which, to my way of thinking, harmonizes excellently well with Edinger's experimental findings and therapeutic results. A no less distinguished clinician and observer than Marie is responsible for the statement that in his amaurotic cases,

than Marie is responsible for the statement that in his amaurotic cases. than Marie is responsible for the statement that in his amaurotic cases, in which, intra vitam, the ataxia and other symptoms were arrested, post-mortem examination revealed a less extensive degeneration in the cord.* Edinger's claim is that bodily overaction increases the degenerative process in the cord and that bodily inaction restricts it. Marie by another route, namely, that of blindness, determines substantially the same fact. In the presence of these data, then, how much nearer are we to a solution of the question, Why does established optic atrophy retard ataxic symptoms? Time was, and only a few years ago, when J. K. Mitchell²⁷ offered the following explanation: "The blindness does result in a certain concealment of some of the tabetic symptoms—the blind patient, if he can walk at all, necessarily does so without seeing his feet; thus, perforce, he acquires some of the greater ease of motion and improvement in station which the tabetics acquire by learning to execute careful coordinate movements-not that they have changed the disease tissues of the cord, but that they use themthey have changed the disease tissues of the cord, but that they use themselves enough better to conceal some of the symptoms of the disorder." Since then Marie's observation has reinforced Edinger's view, and out of the combined issue I believe it is possible to advance a more tenable assertion. The patients with optic atrophy are blind; blind men rather conserve than dissipate muscular energy. They do not overexercise. With them functional wear and tear is at a minimum, and so the disease process in the cord is restricted. A less degenerated cord reciprocally inhibits the other "motor" symptoms. As to why the optic nerve is selected to atrophy in the first place, see note appended on the Edinger compensation theory.

The medical profession has had the Erb-Fournier parasyphilitic postulate so thoroughly impressed upon it that it is unwilling to credit

^{*} A personal communication of Marie to Dr. H. T. Patrick.

any other factor as giving rise to tabes. Some regard, but very little, is shown for von Leyden's conception invoking exposure to wet and cold, and not syphilis, as the chief factor in the cause of the diseasc. Only the fewest are disposed to regard Edinger's theory favorably, although it explains more of the multiform symptoms than any other one hypothesis. Benedickt, who, when he says "tabicus non fit, scd nascitur," emphatically denies every factor but that of heredity, meets with little approval at the hands of the profession.

Summing it all up, this much is incontestable, that tabes is a disease of the sensory neuron, caused, in a vast majority of the cases, by syphilis, which, however, does not stand in direct causal relation.

Coming to a consideration of the cardinal cause in the production of the disease in the negro, and conceding an apparently relative immunity in him, who shall deny that Aryan admixture is not accountable for a predisposition in the man, which, plus his vices and acquired venereal infections, has given rise to the appearance of tabes in him? In support of this view I recall that all of the cases heretofore reported, including my own, in which I have been especially solicitous of detailing the ancestry, occurred in hybrids. McConnell, it is true, reports his cases as those of full-blooded negroes, but adopts the view from the premises of color rather than by inquiry into ancestry. A black negro need not necessarily be a full-blooded negro, and I am not willing to allow that mere observation with respect to varying shades of complexion is convincing.

Conspicuous as is the part played by venereal diseases in the life of the negro, syphilis, so very much more prevalent among the colored, is on the increase, and facts supplied from various authentic sources go to prove that the negro has acquired this infection since the period of slavery through an ever-increasing low standard of sexual morality.

While it has proven futile to insist upon a syphilitic etiology for tabes in the Caucasian, nevertheless, I think a causal relationship as it exists for the whites applies in the blacks.

The query as to why there is so little tabes in the negro when there is so much syphilis is a natural and logical one, which may remain unanswered for the same reason that other paradoxes of factual medicine exist and solution of them is suspended. As well might we seek to explain the absence of tabes in Bosnia and Herzegovina, where, as we know, the most intense constitutional syphilis is rampant among the natives. So far as immunity and susceptibility is concerned, I believe that too much has been taken for granted.

As Dr. Matas' concludes, "there are no diseases which prevail exclusively in the colored any more than there are diseases which prevail exclusively in the white race."

If any conclusions are to be drawn from a consideration of the various

features touched upon in this paper, they may be summarized as follows:

- 1. Long residence with the white man has made the American negro anthropologically, physiologically, and pathologically different from his African ancestors.
- 2. The constitutional variation has been wrought by acclimatization, social environment, and, more than all else, by miscegenation,
- 3. The influence of miscegenation and the advent of personal liberty are responsible for a new era of diseases.
- 4. The newer diseases in the negro, of which tabes is an example, are fast becoming more commonly recognized, miscegenation being regarded as the potent factor in reducing the negro's resistance toward disease.
- 5. Tabes exists in the negro perhaps more commonly than has been supposed, and failure to recognize it may be due to the abeyance or total absence of the ataxic symptoms in the amaurotic type.
- 6. The Edinger-Marie observations anent the optic atrophy satisfactorily explain that class of cases in which the tabes is arrested by blindnese.
- 7. Aryan admixture is essential to the production of tabes in the negro.

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REVIEWS.

THE PRACTICAL MEDICINE SERIES OF YEAR BOOKS, comprising ten volumes. By Gustavus P. Head, M.D. Vol. IV. Gynecology. Edited by Drs. Emilius C. Dudley and William Healy. Chicago: Year Book Publishers. March, 1903.

This volume is one of a series of ten whose aim is to cover the whole of the year's work in medicine and surgery as represented in current literature. The task of selection—an enormous one—has been most carefully prosecuted, and, while the authors do not assume any responsibility for the opinions expressed, there are frequent criticisms inserted. This critical consideration is the most valuable part of the whole book, as it enables the reader, even if untrained in this particular branch of medicine, to form an intelligent conclusion concerning the subject matter of the article under consideration.

A very complete index adds to the usefulness of the volume, as does also the method of grouping the articles under appropriate headings, as Tumors, Traumatisms, etc. In every case the full reference to the original article is appended, thus enabling the reader to consult the article in the original if he desires.

W. R. N.

THE A B C OF PHOTO-MICROGRAPHY. A PRACTICAL HAND-BOOK FOR BEGINNERS. By Dr. W. H. Walmsley. New York: Tennant & Ward, 1902.

This little book should prove of much service to beginners in photomicrography. The subject is treated in a direct, practical manner; the little difficulties, those fatal stumbling-blocks to the beginner in any subject, are pointed out and the way in which they can be overcome

clearly shown.

In discussing the microscope and camera, essentials in the "making of a macroscopic photograph of a microscopic object," the author dwells not only on the manner of doing work with the best apparatus, but also—and this is so important for the majority of students—on the good work that can be done with the very modest appliances possessed by many (medical students and others). The question of what illuminant to use is gone over pretty thoroughly, and, while the preference is given to acetylene, we notice that the author has a very kindly feeling for the easily obtainable coal-oil lamp. Perhaps the best chapter is that devoted to "Negative Making," and in this the author, in a cheery, earnest way, fairly carries the student along with him. The entire pro-

cess of making negatives, working with high and also with low powers, is gone over step by step until the negatives are left drying in the rack.

Some of the plates shown are excellent.

Another chapter, devoted to "Printing Methods; Lantern Slides," does not call for particular comment except that here, as elsewhere, the author has again made an earnest and, we think, successful effort to point out many of the difficulties incident to the work and to indicate the most practical means of overcoming them.

H. M. W.

CANCER AND TUMORS OF THE STOMACH. By SAMUEL FENVICK, M.D., F.R.C.P., and W. SOLTAU FENWICK, M.D. Lond., M.R.C.P. Philadelphia: P. Blakiston's Son & Co., 1903.

This book is the result of a painstaking, statistical, and clinical investigation of the subject of carcinoma of the stomach. It makes no pretensions to any original views regarding the pathology or etiology of cancer, but presents merely the current teachings upon these subjects, with some very good illustrations of rare specimens. To our mind it seems rather unfortunate that the authors should have adopted the method of percentages for recording their results. It is of little value, after all, to know that in 48 per cent. of their cases the pain was severe or continuous; that in 38 per cent. it was occasional; that vomiting occurred in 87 per cent. of the cases; that hemorrhage was present in 34 per cent. and pronounced anorexia in 32 per cent. Such statements are of too little value when taken by themselves. It is really the grouping of symptoms rather than their comparative frequency that enables us to make a diagnosis or to form a prognosis. This appears to be the most serious criticism that can be made of the book. It is full of careful clinical observations, of accounts of cases intelligently studied; it takes an exceedingly rational view of the subject, and the statements impress the reader as being trustworthy. Among some of the interesting details of the work may be mentioned that the authors express a tacit approval of Hemmeter's method of curetting the wall of the stomach with a sharp-edged stomach-tube in order to obtain fragments of the mucosa for microscopic examination. They lay great stress upon the presence of irregular mitoses in the cells in the diagnosis of cancer. They do not regard the presence of enlarged glands above the clavicle as of much value in the diagnosis, and this accords entirely with our own experi-On the other hand, evidence of extensive metastasis to the superficial lymph glands is, of course, always of great significance The list of clinical varieties is perhaps more confused than is entirely satisfactory, and yet it is difficult to see how this could be avoided unless several forms of classification were adopted. It may be interesting to mention the different varieties: 1, carcinoma of the cardia; 2, carcinoma of the body; 3, carcinoma of the pylorus; 4, total infiltration; 5, the latest form; 6, the ascitic form; 7, the dyspeptic form; 8, the anæmic form, of which three subvarieties are recognized; 9, carcinoma originating in simple ulcer; 10, carcinoma of the stomach in early life. The subject of the differential diagnosis is carefully studied, particularly with reference to the different clinical forms. The chapter on Treatment is, however, one

of the briefest of the book, and is only an added illustration of our practical helplessness in the management of this disease. Lavage, rectal feeding, diet, and a few drugs for the relief of the symptoms are suggested, and then the only thing left is surgical intervention. The discussion of the indications and the contraindications for this might have been more complete; but as it is, it is fairly satisfactory. The second part of the book deals with sarcoma and other non-carcinomatous tumors of the stomach, including foreign bodies, such as hair balls, gastroliths, etc., and carcinoma and other tumors of the duodenum. To each chapter there is appended a bibliography, and there is also a very extensive bibliography upon the subject of cancer of the stomach. This greatly enhances the value of the book. It is beautifully bound, printed, and illustrated, and the index is complete without being too large. Taking it altogether, it is a valuable contribution to the subject of gastric disease.

J. S.

NOTHNAGEL'S ENCYCLOPEDIA OF PRACTICAL MEDICINE. American edition. "Diseases of the Liver, Pancreas, and Suprarenal Capsules," by Professors Oser, Neusser, Quineke, and Hoppe-Seyler, with additions by Professor Reginald H. Fitz and Frederick A. Packard, M.D. "Diseases of the Stomach," by Franz Riegel, M.D., edited with additions by Charles Stockton, M.D. Authorized translation from the German, under the editorial supervision of Alfred Stengel, M.D. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

This great work has long been a standard medical encyclopedia in the professional world, but as its precious contents have been accessible only to those who are familiar with the German tongue, the copies of the work on this side of the Atlantic were so scarce as to be practically found only in the larger medical centres of the country. Its translation, therefore, and publication in the form of an American edition has been the source of great gratification to the American profession. choosing the editors who should have charge of the individual volumes as they appeared in this country the very best men in the various lines have been procured. These American editors have not contented themselves with simply supervising the translation of the volumes from the German, but have incorporated into each book the results of the work of their English and American colleagues. The effect has been to transform a purely Teutonie into an international work. In the first of the volumes under consideration this improvement on the original work is rendered particularly noticeable by the incorporation of the results of the work of Opie and Flexner within its pages. Although German investigators had long ago begun the study of pathological conditions of the panereas, their relative frequency and importance has only been realized within recent years, and there is no doubt that the lecture by Dr. Reginald Fitz, one of the editors of this volume, upon "Acute Pancreatitis," which was delivered in February, 1889, was responsible for much of this recently aroused interest in the subject. The fact that he is the most eminent clinical authority on pancreatic diseases in this country lends a peculiar value to his services in the present instance. The section on Diseases of the Liver was the last literary work of its

lamented editor. It exhibits the same care and learning which was the peculiar property of all the literary work of Dr. Packard, and serves to embpasize the loss which the American medical profession has sus-

tained by his premature death.

Professor Riegel's work has been most ably edited in the American edition by Dr. Charles G. Stockton, of Buffalo. Although the work throughout is most admirable, yet for special commendation we would mention the part which deals with the analysis of the stomach-contents. This subject is now so all-important in the diagnosis of pathological conditions of that organ that it is of great value to have so authoritative a statement of the various means that are employed. In a work so complete as the present, one cannot but regret that somewhat more space has not been given to the surgical treatment of gastric diseases. This is the one criticism which we would offer of an otherwise most excellent book. The present volumes do not contain quite the wealth of illustrations which was so noticeable in those previously issued. They are, however, accompanied by plates which amply illustrate the topics under discussion. Both volumes contain large numbers of tables, and are particularly noticeable for the complete bibliographies appended to their various sections.

J. H. G.

EXPERIMENTS ON ANIMALS. By STEPHEN PAGET, with an Introduction by LORD LISTER. New and revised edition. New York: G. P. Putnam's Sons. London: John Murray, 1903.

WE are all familiar with the saying, "Oh that mine enemy would write a book!" and there is no doubt that a large amount of the material which is put forth in controversial literature acts as a boomerang to its authors. Although we trust we have enough intelligence to be entirely out of sympathy with the fanatical vagaries of the antivivisectionists, it was with almost a feeling of regret that we picked up this book, knowing that it would be regarded as a contribution to this aspect of the warfare of science with ignorance. Its perusal, however, has instilled us with profound gratitude to Paget for the great service which he has performed in its compilation. He has not attempted to answer any of the so-called arguments of the antivivisectionists, but has contented himself with a plain, historical résumé of experimentation upon animals in different lines of scientific work.

The first section of the book deals with the history of the experiments by which physiology was raised to the rank of a science and the various functions of the body studied and ascertained by the labors of countless experimenters upon lower animals. The second section considers experiments in the realms of pathology, materia medica, and therapeutics. All the wonderful advances made in our knowledge of tuberculosis, diphtheria, tetanus, typhoid fever, of the properties of snake venom, and in the proper understanding of the transmission of malaria, yellow fever, and various parasitic diseases, are detailed in a graphic and scientific manner, so that the mere recital proves the absolute necessity of animal experimentation to the advancement of medical knowledge.

The last part of the book is devoted to detailing the operations of the law relating to experiments on animals in Great Britain and Ireland.

It is a pity that a work of this character cannot be more widely circulated among the laity. It would hardly be worth while to attempt to popularize it among the antivivisectionists, as that purblind section of the community is hardly worth the effort at conversion, and is only aided in its mischievous work by any attention bestowed upon it. If, however, the ordinary layman could be brought to read, learn, and inwardly digest its contents he would be much less likely to be disturbed by the clamor of the ignorant, who assume that there is another side to this one-sided question.

F. R. P.

A MANUAL OF DISEASES OF THE EYE FOR STUDENTS AND GENERAL PRACTITIONERS. By CLARENCE A. VEASEY, A.M., M.D., Demonstrator of Ophthalmology in the Jefferson Medical College, Assistant Ophthalmic Surgeon to the Jefferson Medical College Hospital, Ophthalmic Surgeon to the Methodist Episcopal Hospital, and Consulting Ophthalmologist to the Philadelphia Lying-in Charity. Illustrated with 194 engravings and 10 colored plates. Philadelphia and New York: Lea Brothers & Co., 1903.

In this book of 412 pages (19 chapters) Dr. Vcasey gives a lucid exposition of the present state of ophthalmology as fully as this can be done in these limits. As the author truly states, the difficulty consists in deciding what is best to include, the amount of material being so great. The choice has been very judiciously made. The writer has succeeded in the purpose he set for himself, namely, "to present in a systematic, practical, and concise manner those facts concerning diseases of the eye which will be of most service to students and practitioners of medicine."

A limited treatise upon a subject of the extent of modern ophthalmology can treat only of the most salient points. If these are judiciously selected, clearly stated, and the views in general sound, everything has been accomplished that can be expected of such a work. The book before us entirely fulfils these conditions. It deserves and will, no doubt, rank with the best works of its class. The reader who has mastered its contents will have to go to the larger and more pretentious works to extend his knowledge of ophthalmology. He will have gained from Dr. Veasey's book all that is possible from a work of its scope.

T. B. S.

ESSAYS ON CLINICAL MEDICINE: being reprints of papers published at various times in The American Journal of the Medical Sciences by Beverley Robinson, A.M., M.D., Paris. Philadelphia: William J. Dornan, 1903.

INTO this volume Dr. Robinson has gathered eleven articles on practical medicine, which he has contributed to the columns of THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES during the last fourteen years. Seven of these essays deal with the diagnosis and

treatment of various cardiac disorders, and it is a great pity that they cannot be in the hands not only of all practitioners, but of every student Their broad and philosophic scope, their very practical nature, and the ease with which they are written render them not only instructive and profitable to the reader, but really delightful reading as There are few clinical teachers who are better qualified than Dr. Robinson, and the ease and charm with which he writes has an individuality all its own.

Of the rest of the essays the first article in the book is on "Creosote as a Remedy in Phthisis Pulmonalis," and is a model of the way in which the true therapeutic value of any remedy should be studied and written of.

In the essay on the course of the "Treatment of Certain Uramic Symptoms" Dr. Robinson deals with some of the various types under which uramia may appear, and with the suitable treatment to be followed under different circumstances.

The article on the "Etiology and Treatment of Certain Kinds of Cough" considers some of the more obscure causes of their symptoms, and is most instructive.

The last two articles, dealing with tuberculosis, pericarditis, and cirrhosis of the liver, are fully up to the standard of the others in interest and charm.

Dr. Robinson is to be heartily congratulated upon the collection of articles which he has gathered together in this work for the benefit of the medical profession.

A REFERENCE HAND-BOOK OF THE MEDICAL SCIENCES: Embracing the Entire Range of Scientific and Practical Medicine and Allied Science, by various writers. A new edition, completely revised and rewritten. Edited by Albert H. Buck, M.D., New York City. Volume VI. Illustrated by chromolithographs and 763 half-tone and wood engravings. New York:

THE revised edition of the Reference Hand-book is now almost all published, and it is gratifying to note that this new issue is not merely a reprint of the previous edition with a few additions, but a complete revision of the whole work. All the articles bear evidence not only of new work on the part of their various authors, but also of careful the revision of the revision of their various authors, but also of careful revision of the revision which the revision which editorial revision. There is no work in the English language which in any way equals this publication in its encyclopedic value to the physician. It is, in reality, a series of well-written monographs on every conceivable topic in medical science. It is impossible in a volume which contains so many articles—most of them of so much importance to single out for particular mention any individual one. Among the groups of articles which will prove of value in special lines of work we would especially notice those on Ophthalmology, on the Nose and Throat, and on the Nervous System. The alphabetical arrangement of the work is such that most of the articles bearing upon these topics are included in this volume of the series.

One particularly noteworthy feature of the plan of the Reference Hand-book is the excellent short bibliographies which accompany the

more important articles. These bibliographical notes are so short that they do not interfere with the space which should be given more particularly to the body of the article, but the references in them are so well chosen that, as a rule, they form a most excellent and reliable guide to the leading publications on the subject under discussion. This makes the work of the greatest service to contributors to medical literature.

Wood's Reference Hand-book is not only a work of which its publishers should be proud, but is to be regarded as one of the most valuable outcomes of scientific medicine in America. The names of its contributors include many leading workers in the various departments of medicine and surgery in America. The book is one which should be in the library of every medical man who attempts to keep up with the progress of his profession.

F. R. P.

EYE SYMPTOMS AS AIDS IN DIAGNOSIS. By EDWARD MAGENNIS, M.D., D.P.H., late Clinical Assistant at the Royal London Ophthalmic Hospital; author of The Eyesight of School Children, Hygiene in the School Room, Healthy House Sites, and The Irish Poor Law System, etc. Bristol: John Wright & Co. London: Simpkin, Marshall, Hamilton, Kent & Co. Limited, 1903.

IF brevity be the soul of wit, this diminutive booklet must be given a high place. It contains 74 pages of text, $3\frac{1}{2}$ by $2\frac{1}{2}$ inches per page of print, plus 11 pages of an ophthalmic glossary. It is far too brief to be of use to the ordinary practitioner; at the same time it has a value for the physician who has paid some attention to ophthalmology, for it is a well-written and terse statement of some important ophthalmic conditions relating to general diseases. The reactions of the pupil in health and disease, palsies of the ocular muscles, fundus lesions, and the different varieties of hemianopsia as focal symptoms of cerebral lesions—all these important matters are quite fairly considered.

T. B. S.

DISEASES OF THE SKIN. A MANUAL FOR STUDENTS AND PRACTITIONERS. By ALFRED SCHALEK, M.D., Instructor of Dermatology, Genito-urinary and Venereal Diseases, Rush Medical College (in affiliation with the University of Chicago), Chicago, Illinois.

This little book of about two hundred pages is an accurate, but extremely brief, presentation of the more important facts of dermatology. The various diseases of the skin are considered in alphabetical order, their symptoms, pathology, causation, and treatment being briefly outlined. To facilitate the use of the book as a quiz compend a series of questions upon the more important points are arranged at the end of each section. While of little use to the practitioner, since it is nothing more than the briefest outline of the subject, the manual will probably be found useful by the student if used in conjunction with one of the larger treatises.

M. B. H.

THE ELEMENTS OF PATHOLOGICAL ANATOMY AND HISTOLOGY FOR STU-DENTS. By WALTER SYDNEY LAZARUS-BARLOW, B.A., B.C., M.D. Camb., F. R.C.P. Lond., Pathologist and Lecturer on Pathology at the Westminster Hospital. Author of *A Manual of General Pathology*. Philadelphia: P. Blakiston's Son & Co., 1903.

THE present volume, designed as it is for the use of students, is an excellent example of the best type of this class of text-book. The general treatment of the subject is fundamentally good. The descriptions of various pathological processes, though short, are concise, and in almost every instance the important points are clearly brought out, while the confusing details are suppressed. Many of the illustrations lend personal tone to the book, a feature which is so often lacking in similar works, and, in spite of the fact that some of the cuts are not quite up to the standard, none are stereotyped or hackneyed. Bacteriology is very wisely omitted. The pathology of certain organs, for instance the spleen and lymph glands, is, perhaps, too briefly treated, and occasionally, as in the case of typhoid fever, the histological changes are not described in such detail as one might wish, and yet little that is important is omitted. Theoretical discussions are carefully avoided, and no conflicting authorities are quoted. Indeed, the total lack of reference to any literature upon pathology does not impress one as being altogether stimulating for the student. The book is divided into two parts. The first deals with general pathological anatomy and histology, while the second is confined to a discussion of the pathological anatomy and histology of special organs and tissues. In the first part the sections on Inflammation and New-growths are especially noteworthy. In the second part the pathology of the various organs is discussed in turn. The section on Bones is particularly good. The addition of such special subjects as the skin, eye, and ear is very useful. The pathology of the nervous system is shortly and concisely treated. Certainly the intricate problems concerning nerve degeneration belong strictly to the domain of the neuropathologist, and the author has not dealt to any extent with these conditions. The section on the Nervous System, therefore, keeps its due proportion in the work as a whole. Altogether the book is valuable and forms a most excellent introduction to the study of pathology. It is well written, well printed, and supplied with a full index.

THE PRACTICAL MEDICINE SERIES OF YEAR BOOKS, comprising ten volumes on the Year's Progress in Medicine and Surgery. Issued monthly. Under the general editorial charge of Gustavus P. Head, M.D. Volume III. The Eye, Ear, Nose, and Throat. December, 1902. Chicago: The Year Book Publishers.

It is a pleasure to add to the tribute of praise which has been extended to this excellent little series of year books. The present volume is fully up to the standard of its companions, and maintains the place so well won by previous issues. It contains rather more illustrations than in other volumes of the series, which add very materially to its value.

F. R. P.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND,

AND

W. S. THAYER, M.D.,

ASSOCIATE PROFESSOR OF MEDICINE IN JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

Trypanosomiasis in Man.—Until within the last year it was believed that diseases due to infection with some form of trypanosoma were confined to the lower animals. Up to the present time four well-known diseases occurring in lower animals have been shown to be associated with the presence of trypanosomes in the blood. These are:

- 1. Surra, the organism which was discovered by Dr. G. Evans, in 1880, in horses and other animals in the northwest provinces of India.
- 2. Nagana, a disease attacking horses, cattle, and other animals in Central Africa and other regions. This form of the parasite was discovered by Bruce in 1894. The disease is transmitted by the tsetse-fly, and is also known as the tsetse-fly disease.
- 3. Mal de caderas, very similar to surra and nagana, occurring in Central America and Brazil, and produced by a trypanosoma probably identical with T. brucei.
- 4. Dourine, or maladie du coït, occurring in Algeria, Southern France, Spain, and Turkey, the pathological agent of which is the T. equiperdum (Doflein), T. rougeti (Laveran).

There has been considerable controversy as to who descrives the credit of having first detected the presence of trypanosomes in the blood of human beings. It is only just to say that Nepveu, while studying malaria in Algeria between 1890 and 1898, discovered a flagellate body in the blood of a human being which he recognized as being a trypanosome. His observations were not published until 1898 (Comptes Rendus des Séances de la Société de Biologie, December 24, 1898), and it does not seem to have attracted much attention. The attention of those interested in tropical diseases was not specially directed

to human trypanosomiasis until the report of a case by Dutton (Thompson Yates Laboratory Reports, vol. iv., part ii., May, 1902, and British Medical Journal, September 20, 1902, p. 881) and Forde (Journal of Tropical Medicine, September 1, 1902). This case occurred at Bathurst, Gambia, and had been for some time under Forde's observation, and was referred to Dutton, who had been sent out by the Liverpool School of Tropical Medicine to study the source and distribution of mosquitoes in the town. The patient was not a native, but an Englishman, in the employment of the government.

Trypanosomiasis, as illustrated by this and subsequently described cases, is characterized by well-marked general wasting and weakness; cedema of the face, trunk, and legs; patches of multiform erythema of the trunk and extremities; frequent pulse and respirations; marked enlargement of the spleen; moderate anæmia; and irregular fever of a relapsing type. The disease is extremely chronic in character.

In fresh blood the parasite appears as a very minute, worm-like organism, difficult to detect with a magnification of 300 diameters. It glides fairly rapidly among the red cells, imparting very little motion to them. One end is drawn out into a whip-like process—the flagellum. The other end is bluntly conical. Attached along one side of the body is a transparent, flange-like process—the undulating membrane. A refractile spot (vacuole) is situated toward the posterior end. The parasite when in active motion moves in a screw-like manner, its body rotating around the longitudinal axis. The organism stains by a modification of the Romanwsky method, and has a nucleus situated a little anterior to the middle. A micronucleus or centrosome is also demonstrable in the neighborhood of the vacuole. In stained specimens the parasite averages 22μ in length and 2μ to 2.8u in breadth.

Dutton made no inoculations of the human blood containing these trypanosomes into animals, and was not able to prove its identity with the trypanosomes occurring in lower animals. Specimens were examined by Laveran, who did not think that it was identical with any of those seen in lower animals. Dutton, therefore, thinks that it is a new species, and suggests the name trypanosoma gambiense. He believes that it is unquestionably the cause of the symptoms manifested by the patient.

Manson and Daniels (British Medical Journal, May 30, 1903, p. 1249) report an almost identical case in a woman missionary, aged forty years, who had been referred to them after she had returned from the Congo Free State. An interesting point in the history of this case is that she was bitten in the leg by some insect two weeks previous to the onset of the symptoms. The differential count of the leucocytes in this case showed a great increase of the large mononuclears at the expense of the polymorphonuclears and eosinophiles. The parasites were uninfluenced by quinine, arsenic, and methylene blue. Having found that horses were not susceptible to inoculations of this trypanosome, the writers attempted treatment of the case by injecting horse's blood serum into the subcutaneous tissue, without any effect on the organisms and with rather disastrous effects on the patient's general condition.

In support of the view that trypanosomiasis is of rather wide distribution in Africa is the fact that Baker (*British Medical Journal*, May 30, 1903, p. 1254) has recently reported three cases, all in natives, from Uganda. These, however, were mild and of short duration.

Castellani (The Lancet, June 20, 1903, p. 1735) has made a very important observation regarding the etiology of "sleeping-sickness" in Africa. His observations were made in Uganda. In thirty-four cases of sleeping-sickness trypanosomes were found in the cerebrospinal fluid obtained by lumbar puncture in twenty cases. The species was very similar to if not identical with the T. gambiense of Dutton. After Castellani left Uganda his investigations were continued by Bruce. The results in his series were even more remarkable. The trypanosomes were found in the cerebrospinal fluid in every one of thirty-eight cases of sleeping-sickness, and in the blood in twelve out of thirteen cases of the same disease.

Trypanosomiasis occurs in rats in this country, and Novy, of Ann Arbor, reported at the recent meeting of the American Medical Association that he had grown the parasite in pure culture on rabbit's blood serum mixed with agar. The growth does not occur on the surface of the nutritive medium, but in the water of condensation.

On the Etiology of Variola.—The organism which COUNCILMAN, MAGRATH, and BRINCKERHOFF (The Journal of Medical Research, May, 1903, p. 372) believe to be the cause of smallpox apparently belongs to the sporozoa class of the protozoa. It appears first in the lower layers of the cpithelial cells of the skin (before there is any anatomical evidence of vesiculation) as a structureless body from one to four microns in diameter. These bodies, one or more in number, lie in vacuoles in the cells. They gradually increase in size, and granules, embedded in a reticulum, appear within them. A definite nucleus has not yet been seen. The body now segments into a number of round bodies one micron in diameter. At the time of segmentation, and when most of the intracellular bodies have disappeared, small round or oval, ringlike bodies appear in the nucleus. These increase in size and acquire a definite structure, consisting of a series of vacuoles around a large central The intranuclear body eventually entirely destroys the nucleus, and later the cell itself ruptures, setting it free. The intranuclear body becomes transformed into a number of circular, ring-like bodics with a central dot. These are evidently spores from segmentation of the intranuclear body. The investigators regard this intranuclear body as a further stage of development of the intracellular body, and as representing a second complete cycle of development. It is the spores of the intranuclear body which they regard as the infecting material of variola. In vaccination of the rabbit and calf Dr. Tyzzer has found only the intracellular forms. The inoculation of the rabbit with the contents of the variola pustules gives rise to bodies similar to those in vaccinia and in the first cycle of variola. Here also only the intracellular bodies have been found. Inoculation of the monkey with contents of variola pustules produces lesions which they regard as variola, and in these both the intracellular and intranuclear cycles are found, occurring in the same sequence as in man. From these experiments they regard it as extremely probable that in smallpox the complete development of the parasite through two cycles takes place, and that in vaccinia the primary cycle only. In the contents of the vesicles and pustules they have seen forms of the intranuclear bodies which seem to show that the intranuclear cycle is sexual in character.

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

JOHN RHEA BARTON PROFESSOR OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY HOSPITAL.

AND

F. D. PATTERSON, M.D.,

SURGEON TO THE X-RAY DEPARTMENT OF THE HOWARD HOSPITAL; CLINICAL ASSISTANT TO THE OUT-PATIENT SURGICAL DEPARTMENT OF THE JEFFERSON HOSPITAL.

The Treatment of Prostatic Hypertrophy.-Roysing (Archiv f. klin. Chir., Band lxviii., Heft 4), in an admirable and exhaustive consideration of this important subject, states that the first method of treatment was by catheterization, which not only had its disadvantages, but by reason of its danger soon fell into disuse. Then came the method of Bier, based on the false presumption that the prostate of man is analogous to the uterus of woman, and that the hypertrophy of the former is a myomatous condition. The danger of this method was clearly pointed out when the statistics showed a mortality of 30 per cent. Then came Ramin and White, who proposed and recommended castration. This method was based on sound theory as well as on the results of animal experimentation, which latter showed that the removal of one testicle was followed by a decrease in the size of the corresponding half of the prostate. But this method was not constant in its results: some cases were benefited and still others unimproved, and about 50 per cent. were cured. Then Isnardi, in 1895, recommended vasectomy. The principle is the same as that of castration, only, the testicles not being removed, the cosmetic effect is better. The operation has also proven itself to be less dangerous, as it may be performed without a general anæsthetic. . Trendelenburg, in 1897, revived the same operation as Bottini had proposed in 1874, and which bears his name—the galvanocautery incision. So if one refers alone to the literature the proper treatment of any given case becomes a great question, but it is to be remembered that each method has its value, and the remaining question to be settled is, under what circumstances and which surroundings, which operation is the best; for no one method is the best treatment for every case. The view of Cinkanowski, that a kind of antagonism exists between the gonorrheal inflammation and prostatic hypertrophy, is not borne out by a careful consideration of the history of many cases and by histological examination. The greater majority of prostatics belong to the minority of individuals who have not had gonorrhea. Prostatic hypertrophy is only a senile condition, and it is a proof of the weakening of the sexual apparatus. This seems like a contradiction to say that a hyperplasia of the glandular tissue of this organ is the result of senile degeneration when this, as a rule, is shown by atrophy in other organs. What is the function of the prostate under normal conditions? It is, as Türbringer has clearly shown, the secretion of a fluid which is a necessary adjunct to

the motility of the spermatozoa. That hypertrophy does not take place in order to make up, as it were, for a decrease in the semen is clearly shown by the fact that an atrophy of the gland takes place when castration or vasectomy is performed.

The author reports a series of 126 cases treated by catheterization, in all of which there was a medium grade of hypertrophy. In the first group are 7 cases in which there was practically total retention with pain, and in whom an immediate operation was not advisable. In the second group are 10 cases which were characterized by partial retention, with frequent urination and pain. These were catheterized at intervals, and in two to three weeks had progressed so that they could wholly empty the bladder, but in a few more weeks or months the old symptoms of pain and partial retention returned. In the next group of 91 cases the symptom of retention was not benefited and the treatment was only palliative. In the next group of 15 cases, in which partial retention was the greatest symptom, the catheterization did harm and the patients were unable to spontaneously evacuate the bladder. of the 126 cases the catheter treatment had absolutely no beneficial effect on the retention, and in these patients came the question whether or not to begin catheter life or to operate. In 11 cases the urinary passages were so infected by the catheterization that operation was out of the question, and all of them eventually died as the result of an infective pyelonephritis. The statement that prostatic hypertrophy can be cured by catheterization is thoroughly unwarranted.

Five cases of double-sided castration are next reported. Briefly stated, the first patient was aged eighty-five years, and had not had gonorrhea. For the past eleven years he had catheterized himself four times daily, as he had complete retention. An examination showed that the prostate was enormous, though soft. Five weeks after the operation he passed his urine voluntarily, and continues to do so. The second case, a man of seventy-six years, with a negative history as regards gonorrhoa; catheter treatment of no benefit; suffering from a medium-sized hypertrophy, with a residual urine of 200 to 300 cubic centimetres. The patient made a complete recovery, and when seen six years later seemed to be perfectly well. The third case, a man of sixty-four years, with a negative history as regards gonorrhea; catheter treatment was of no benefit. History of partial retention and painful urination, with about 200 cubic centimetres of residual urine and a large, sanguineous prostate; made a complete recovery, and when seen six years later was apparently perfectly well. The fourth case, a man of fifty-six years, had a previous history of posterior urethritis and prostatitis. He was worse after catheterization, and bad 970 cubic centimetres of residual urine, and his condition was such that it was not advisable to fully empty the There was complete retention, and the prostate was densely hard, fibrous, and somewhat enlarged. When seen three months later his condition was unchanged and he voided all his urine through a catheter. The last case, aged seventy-eight years, with a previous history of gonorrhoa, had had an ammoniacal cystitis secondary to catheterization. The prostate was hard and of a medium degree of enlargement, with 200 to 300 cubic centimetres of residual urine. The operation was without benefit, and the patient is obliged to use a catheter regularly. As one can see, the result of these

few cases of castration is in no way bad—60 per cent, were cured. A further analysis of these cases shows that the operation in all the cases had a beneficial effect on that most distressing symptom—retention. In the two patients in whom the operation was apparently without influence in decreasing the size of the prostate an inquiry into their previous history shows that each had had gonorrhæa, with a resulting posterior urethritis and prostatitis. In these cases the prostate was hard in consistence, fibrous in texture, and tightly adherent, while in the other cases which had no venereal history the prostate was soft and sanguineous or boggy and freely movable.

The results of 40 cases of double retention of the vas deferens were 27 cured. 9 improved, and in 4 cases no appreciable changes. By the term cured is not meant a disappearance of the hypertrophy, but instead a disappearance of such symptoms as pain, with the reduction of the residual urine to a minimum quantity. Three of these cases after an interval of six months, one and two years, respectively, have had a recurrence of their symptoms, and have required a Bottini operation for their relief. The other 24 cases have remained well during the following periods since the operation: 3 cases, six years; 4 cases, five years; 4 cases, four years; 1 case, three years; 5 cases, two years; 2 cases, one year; and 5 cases, from six to nine months. So one sees that in 60 per cent. of these cases the patients were relieved of their disagreeable symptoms for a ranging period of time, but one cannot say that this result is permanent, for in one case there was a return of the symptoms after an interval of two years. Still one may hope that the results from this operation will be permanent, for in a greater proportion of the cases the patients are still well after an interval of from four to six years. In none of these cases were there any serious sequelæ after the operation, and the only death soon after the operation was that of a man, seventy-five years old, who suffered from a severe nephritis, and who died of uræmia fourteen days later. In the mean time, as the result of the operation, the severe hemorrhages from the prostate, which had been his most troublesome symptom, had ceased. In addition, this operation avoids the mental anguish which so often follows castration. In many of the cases the prostatic hemorrhage stopped almost immediately after the operation. The retention was also improved, but in two to six months it again became a noticeable symptom. In two cases a Bottini operation was done later, and in two others cystostomy, and in five others the improvement, though marked, was not constant, and they were obliged to urinate often and with difficulty. In 10 per cent. of the cases the operation was without result, and these four patients later came to cystostomy. These cases were all characterized by a tremendously large prostate, with a swollen bladder and total retention.

Fourteen cases were subjected to the Bottini operation, and of these 2 were cured, 5 improved, 6 made worse, and 1 died; or, in other words, only 14 per cent. were cured, not quite 36 per cent. were improved, 43 per cent. were made worse, and 7 per cent. died. More careful consideration of this list shows that in what at first sight seems to be two cured cases the residual urine was 200 and 150 cubic centimetres, and in the first of these cases the post-operative period was characterized by the dangerous symptoms of chills and high fever, as the result of an infection of the prostatic wound from an old cystitis. In the second case a vasectomy had been per-

formed eleven mouths before, and for six mouths afterward the patient had improved, but then began to be worse again, and the Bottini operation was followed by a most satisfactory result. There were two cases of hemorrhage in the second group, due to a failure of technique in having the knife at white heat instead of red hot. It follows as a matter of course that burns are at best a hard wound to heal, and this is especially true in the case of the prostate, where the wound is constantly in contact with infected urine and also at a point where there is a sphincter. The cases that are not followed by pain and irritation on urinating after this operation are those where the operation has been of very little value, as the median lobe of the prostate has not been involved in the hypertrophic process, and the wound made by the knife soon heals.

Partial suprapubic prostatectomy: The author reports 6 cases in which he made a suprapubic extirpation of the median lobe with most satisfactory results.

Cystostomy: There were 21 cases, of which none died from the operation, but 4 died shortly afterward of advanced kidney disease, from which they suffered, while the others still enjoy good health. In 3 of them urination was normal at the end of six months. In 1 case vasectomy was performed simultaneously with the cystostomy, and in 2 others a Bottini operation had been performed a few weeks before. The author believes cystostomy to be indicated when a large, swollen bladder is present, whose contractile power is either very slight or absolutely wanting; when catheter life is so hard that it becomes a burden; in the presence of an incurable cystitis, and in the presence of repeated attacks of hemorrhage from the prostate.

Conclusions. The author states that if called upon to treat a patient who has never before been under treatment, and who suffers from a mild degree of partial retention, or perhaps total retention, the first thing to try is regular catheterization. In a large proportion of cases this is followed by very great relief to the patient, but one should not forget, and should also make the patient clearly understand, that this method of treatment will not result in a cure. If, however, the case is one with a markedly swollen bladder, or, in other words, there is a large amount of residual urine, the best treatment is a vasectomy as soon as possible, and eventually prostatectomy, for in these cases catheter treatment is usually of no avail, and is often dangerous from the introduction of micro-organisms. In those cases where the patient has used a catheter for a long while and suffers from either partial or total retention, a vasectomy, followed, if necessary, by prostatectomy, is the operation of choice. In those cases where there is total retention with cystitis, which, on catheterization, have hemorrhage, chills, and fever, a cystostomy with a simultaneous or subsequent vasectomy is to be recommended. As a result of the vasectomy the prostate will atrophy, and then an attempt should be made to close the fistula. If normal urination is not possible as the result of vasectomy or castration, then one has the choice between cystostomy and regular catheterization. The latter is to be recommended in those cases who, by reason of education and environment, are enabled to carry out the treatment carefully, and who do not find catheter life too trying. On the other hand, when the patient belongs to the poorer classes, cystostomy is to be recommended. It is to be remembered that in the use of the catheter

there is always the danger of infection and hemorrhage, and so such a patient may truly he said to be living over a volcano. The author states that the total extirpation of the prostate is a very severe operation when one considers the age and physical condition of the average prostatic, but the operation should be fairly successful in those who have not yet reached an advanced age and who are still vigorous. Still one should remember that opposed to this operation, as also in castration, is the fact that the sexual apparatus is mutilated to a marked degree, and this is often followed by much mental anguish. Sexual life is abruptly closed by this radical operation, and the author helieves that it should never be performed until a vasectomy has heen tried and proved itself a failure.

The Radical Operation for Congenital Inguinal Hernia in Young Children.-KAREWSKI (Centralblatt f. Chir., 1902, No. 51) states that the remarks by Klemm in No. 46 of that journal convince one that the difficulties of isolating the spermatic cord are greatly increased when one cuts down only as far as the serosa and then allows the tunica vaginalis to escape from the innermost layer of the sac. In no case did a parenchymatous hemorrhage or an accident to the cord or vas deferens take place. The isolation of the cord can be undertaken without difficulty to the internal ring; at that point the peritoneum should be drawn together and sutured, and as a result one obtains a support which will only give way as the result of a severe The Bassini and other radical operations do not seem indicated except in those cases of large scrotal hernia. This simple method of treatment has proved its worth in many cases, some of whom have remained perfectly well for periods of ten and twelve years. The advantages are that it can be performed in a few minutes, and the wound, which is well removed from the danger of urine contamination, is usually cicatrized in eight or The greater proportion of the author's cases lived under most unfavorable surroundings, but every case was followed by a good result. It is best during the first few days after the operation to dress the wound daily with iodoform, for which vioform may later be substituted.

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD WEBB WILCOX, M.D., LL.D.,

PROFESSOR OF MEDICINE AND THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL,

AND

SMITH ELY JELLIFFE, M.D., PH.D.,

PROFESSOR OF PHARMACOGNOSY AT THE COLLEGE OF PHARMACY; INSTRUCTOR IN MATERIA MEDICA AND THERAPEUTICS (COLUMBIA UNIVERSITY), NEW YORK,

The Coal-tar Drugs in General Nervous Affections.—Dr. F. SAVARY PEARCE prefaces his more detailed remarks by the statement that the coal-tar products have their physiological and pathological action in the main

through impression of the central nervous system, and act according as they affect the centres governing trophic nerves or as they control or depress vasomotor competency. He speaks of the danger of administering these drugs for the relief of pain, as in the headache of neurasthenia, without treating the disease, and quotes an interesting case of the drug-habit thus formed. He thinks the use of the coal-tar products has been overdone in cases of hysteria, and warns against their use in case of pain arising from brain tumor; also in typhoid with cardiac failure, and in meningitis, which he prefers to treat without the use of an analgesic. He advocates the use of antipyrin, however, in hyperpyrexia due to cerebral or other disease, in some cases of idiopathic epilepsy, and in combination with acetanilid to relieve the paroxysms of pain in tabes dorsalis. He considers one of the most valuable indications for the coal-tar products in nervous diseases to be in disease of the spinal cord, but thinks there is little need of these drugs in organic disease of the central nervous system.—Therapeutic Gazette, 1903, vol. xxvii., p. 9.

Aqueous Preparations of Menthol.—Dr. M. Cresantignes describes a method of obtaining an aqueous solution of menthol without the addition of the large amount of alcohol generally considered necessary to dissolve it. He has found it excellent as an antiemetic, having proved by administering it after ipecac that it controls the reaction of the latter. In vomiting of reflex origin he has found it excellent, and, except in cases of gastralgia, he has used it to inhibit the spasm. He has succeeded in obtaining a satisfactory aqueous solution of menthol by using the tincture of quillaja saponaria, used by druggists in making emulsions. His formula is as follows: Menthol, 5; tincture of quillaja, 500; distilled water, 101 to 2500. After the menthol is dissolved in the tincture glycerin is added, and then the water in small quantities, and shaken thoroughly. Two drachms constitute a dose. The amount of menthol in each dose is very small, but it is better to give it thus diluted, several spoonfuls at a time if necessary, as in more concentrated solution it is apt to burn. For external application he recommends the following formula, which he finds relieves frontal headache due to fever or other causes when applied as a wet compress for a few minutes only, and followed by a compress of fresh water: Menthol, 30; tincture of quillaja, 10; distilled water, to 155. As a gargle and mouthwash he recommends the following: Menthol, 20; tincture of quillaja, 20; saturated aqueous solution of boric acid, 1000.—Les Nouveaux Remedies, 1903, vol. xix., No 1, p. 1.

The Influence of Some Modern Drugs on Metabolism in Gout.—Dr. WILLIAM BAIN says that the increasing attention paid to the observations in the constitution of the nrine in gout has been partly directed to the relative preparations of the nitrogenous end-products. From the standpoint of therapeutics he has studied a number of newer drugs, particularly with reference to their effect on these nitrogenous end-products. The products studied were piperidin tartrate, lithium benzoate, piperizin, lysidin, urotropin, sidonal, and colchisal. With the main object of ascertaining the influence of the drugs mentioned they were administered to a case of chronic gout,

the patient being on a fixed diet during the investigation. With reference to his results he found that piperidin tartrate showed but slight influence on the excretion of uric acid, but that the rise after its discontinuance warrants the hope of more defiuite results if given in larger doses for a longer period. Lithium benzonte seemed to give absolutely no results; piperizin had a slight augmentive influence on the excretion of uric acid, but a more striking variation was the diminution in the aromatic sulphates. Lysidin gave a distinct increase in the uric acid excretion. Urotropin, so far as uric acid was concerned, gave no results. Sidonal gave the most marked advances in the uric acid excretion. Colchisal stood at the opposite end to sidonal, with a minimum excretion, and it is noted that the ethereal sulphates rose to a high point. The patient was of the opinion that he derived greater benefit from colchisal than from any of the other prescribed substances.—British Medical Journal, 1903, No. 2196, p. 243.

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE; PROFESSOR OF OBSTETRICS AND DISEASES OF INFANCY IN THE PHILADELPHIA POLYCLINIC; CLINICAL PROFESSOR OF DISEASES OF CHILDREN IN THE WOMAN'S MEDICAL COLLEGE; VISITING OBSTETRICIAN TO THE PHILADELPHIA HOSPITAL, ETC.

An Unusual Case of Rupture of the Uterus. - In the Monatsschrift f. Geburtshülfe und Gynäkologie, 1903, Band xvii., Heft 6, KNAUER reports the following interesting and remarkable case: The patient was a multipara, admitted to the hospital in labor after an unsuccessful attempt to deliver by the use of forceps. On examination the condition of the abdomen and the patient's prostration and shock pointed to rupture of the uterus. fætal head was above the entrance to the pelvis, and the fætal heart sounds could not be heard. The cervix was dilated and the membranes ruptured, and no serious injury to the uterus could be detected. The pelvis was not contracted. After craniotomy examination of the interior of the womb was made and the lower uterine segment was found apparently uninjured. the left broad ligament there was a tumor as large as a fist close to the nterus. The tumor was apparently a hæmatoma. The pulse was small and frequent, although it was thought that internal hemorrhage was not proceeding. Cold was applied to the abdomen, and during the following night the patient vomited and the abdomen became distended. labor the patient died, her condition not justifying abdominal section.

Upon autopsy a hæmatoma was found in the left broad ligament, extending to the symphysis and dissecting up the peritoneum. This hæmatoma had ruptured, permitting free hemorrhage into the abdominal cavity. In the right side of the pelvis, near the acetabulum, was found a mass of hard lymphatic glands, tuberculous in nature. A rupture in the uterine muscle

was found without an injury to the outer serous layer covering the lower uterine segment. The tissues surrounding the uterus had been adherent at the location of the enlarged glands, and the disturbance incident to labor had torn the adhesions and had caused rupture.

Knauer also reports the case of a multipara who had a tedious labor, during which an elastic dilator was introduced to hasten delivery. Symptoms of premature separation of the placenta occurred, and the membranes were ruptured, the cervix dilated with Bossi's dilator, and craniotomy was rapidly performed. The patient collapsed after delivery, and soon died.

On autopsy numerous ruptures in the posterior wall of the uterus on the left side were found opening into the muscular tissue and through the adjacent tissue. The placenta had prematurely separated.

The writer also reports a case of chronic Bright's disease, with hypertrophy of the heart, hemorrhagic hepatitis, and infarcts in the uterus, with hemorrhage. Additional cases are cited to show that it is possible for hemorrhage to occur from the uterus without rupturing the peritoneal covering. Some of these cases are accompanied by premature separation of the placenta.

Artificial Rupture of the Membranes as an Aid to Labor.—GIBB (Scottish Medical Journal, April, 1903) calls attention to cases in which the presence of the amniotic liquid acts as an obstacle to the progress of labor. He describes a case of polyhydramnios in which labor remained at a standstill until the membranes were ruptured, when premature twins were born. He also describes the case of a multipara in labor with no water in front of the head and with delay in labor. On rupturing the membrane labor proceeded. He reports a case in which the lips of the cervix were very thick and the water in front of the head very scanty. Long delay occurred in labor until the membranes were ruptured, when the child was soon born. He also describes three cases of hemorrhage from partial separation of the placenta in which spontaneous delivery and recovery of the mother followed rupture of the membranes.

The writer recognizes the value of an amniotic liquid when it collects before the head in moderate quantity. Under these circumstances the membranes should not be ruptured; when, however, the amniotic liquid is present in excess or is deficient, labor will be expedited by rupturing the membranes.

Hysterectomy for Puerperal Septic Infection.—In the Revue Pratique d'Obstétrique of May, 1903, Pinard expresses his positive belief that hysterectomy is not indicated in puerperal septic infection. In a total of 26,952 cases of labor at term and abortion the septic mortality was one-fourth of 1 per cent. Hysterectomy was performed in two cases. One was septic after labor at term, and thrombophlebitis with suppuration in and about the uterus was diagnosticated. Hysterectomy was performed on the tenth day after labor. Autopsy showed suppurating pleurisy upon the left side, caused by a streptococcus infection. This had not been diagnosed.

The second case occurred after labor at full term attended by a midwife. In the absence of other signs the patient was believed to have multiple

abscesses in the wall of the uterus. Hysterectomy was performed, the cervical canal being cauterized and drainage employed. At autopsy it was found that suppurating phlebitis in the uterine and ovarian veins of the right side was present.

Pinard concludes that hysterectomy is not indicated in the treatment of puerperal septic infection. He excepts cases of suppurating fibroids or cases in which the placenta is adherent and cannot be removed, and cases in which the uterus has been ruptured during labor.

GYNECOLOGY.

UNDER THE CHARGE OF

HENRY C. COE, M.D.,

ASSISTED BY

WILLIAM E. STUDDIFORD, M.D.

Gonorrheal Peritonitis.—HUNNER and HARRIS (Johns Hopkins Hospital Bulletin, 1902, No. 6) report seven cases of acute diffuse peritonitis of gonorrheal origin, with two deaths after operation. They have collected thirtynine cases, of which twenty-four were operated upon, with a mortality of 20.8 per cent., the mortality without operation being 46.7 per cent. The mortality is especially high in children.

Cancer of the Vagina due to Mechanical Irritant.—Maly (Zentralblatt für Gynäkologie, 1903, No. 27) reports a case of extensive cancer of the vagina due to the long-continued pressure of a rubber ring pessary, and refers to six other similar cases mentioned in Veit's monograph on Diseases of the Vagina. The disease developed at the point of greatest pressure; that is, in the posterior fornix or just behind the symphysis in the case of a Hodge pessary, and on the lateral walls when a ring was used.

In the case reported an erosion first appeared, which healed when the ring was removed, and returned and became cancerous when the pessary was again worn. Uncleanliness seemed to be an etiological factor. In view of the rare occurrence of cancer of the vagina in patients wearing pessaries for a long time (in one instance nearly forty years) the writer infers that there must be but a slight predisposition to development of the disease from mechanical irritation. As regards the question of the origin of cancer from erosions, he offers the explanation that in the attempt at repair the formation of new tissue may become excessive, so as to destroy the equilibrium between epithelium and connective tissue.

Retroversion and Appendicitis.—Neugebauer (Zentralblatt für Gynä-kologie, 1903, No. 27) reports five successful cases in which appendectomy and Alexander's operation were performed simultaneously. In all the diagnosis

of appendicitis was made before operation. After shortening the round ligaments the incision on the right side was extended upward to the appendical region. The writer opposes a median incision in these cases on account of the difficulty of reaching and removing the appendix when situated behind the excum or buried in adhesions, and also the necessity of making an additional lateral incision for the purpose of drainage. It is assumed that the uterus and adnexa are perfectly movable.

Sarcoma of the Uterus with Extensive Thrombosis.—Hennicke (Zentralblatt für Gynäkologie, 1903, No. 27) reports the case of a multipara, aged fifty-seven years, who entered the hospital with a large nodular uterus and a hard, irregular tumor filling Douglas' pouch. On opening the abdomen an intraligamentary growth was found, which corresponded in situation to the ovarian vein and could be traced upward as a thick cord in the direction of the kidney. The uterus and tumor were removed, the patient making a good recovery and having no evidences of recurrence a year after operation. The uterine neoplasm proved to be a spindle-celled sarcoma which had extended into both the uterine and ovarian veins. It was evident that the disease had also involved the adventitia and grown toward the lumen. The case is regarded as unique.

Treatment of Uterine Fibroid.—Kannegisser (Journ, Akusch. i Shensk. bolesnej; Zentralblatt für Gynäkologie, 1903, No. 27) reports 462 operations for fibroid in Ott's clinic up to January 1, 1902. The indications for operation were profuse hemorrhage, rapid growth, pain and pressure symptoms, and inability to work. Conservative work was done in 14 per cent. Supravaginal amputation was performed 85 times with 15 deaths; 210 vaginal operations were done with only 7 deaths; total abdominal extirpation in 75 cases was followed by 6 deaths. The writer infers from these statistics that total extirpation with vaginal drainage is preferable to supravaginal amputation except in cases in which it is necessary to shorten the operation on account of the weak condition of the patient. Abdominal section is to be elected only when it is impossible to remove the tumor per vaginam.

Effect of Ligation of the Uterine Vessels.—Gussakow (Journ. Akusch. i Shensk. bolesnej; Zentralblatt für Gynäkologie, 1903, No. 27) draws these conclusions as the result of a series of experiments in rabbits: The uterus is normally nourished by the uterine arteries, and when these are ligated atrophy of both the endometrium and muscular tissuc results. In the human subject double ligatures must be applied to both arteries on account of the free anastomoses between the vessels. It is also important to tic the arterial branches which extend outward from the uterine cornua and anastomose with branches of the ovarian.

No especial skill is required in the operation, which is preferable to all other palliative measures in the treatment of uterine fibroid as well as in cases in which a radical operation is not practicable.

Neuralgia due to Gonorrhea.—Kalabin (Zentrablatt für Gynäkologie, 1903, No. 27) reports two cases of sciatica and intercostal neuralgia in

recently married women with acute gonorrheal infection. In both instances the nerve pains appeared two weeks after the beginning of the discharge and continued for a month. The writer infers a direct ctiological relation between the two conditions, possibly explained by irritation of the cerebral centre by gonococci.

Lymphatics of the Ovary.—Polano (Monatsschrift f. Geb. u. Gyn., Band xvii., Heft 4) conducted a series of experiments on dogs with the view of determining if obstruction to the flow of lymph in the minute vessels follows ligation of the main trunks. Great care was taken to isolate the afferent and efferent lymphatics in the meso-ovarium, so as not to include the bloodvessels in the ligatures. Six human ovaries were also injected and studied. The writer's conclusions are as follows: In the cortex the fine lymphatics are distributed around the periphery of the follicles, the tunica interna and granulosa containing none. In the corpora lutea and albicantia the lymphatics are found only in tissue derived from the tunica externa. A network of lymphatics surrounds the younger, deep-scatcd follicles, but these are absent in the neighborhood of the ripe superficial ovisacs. No lymph vessels could be demonstrated in the albuginea, but they became larger toward the zona granulosa, where larger lacunæ were seen, lined with endothelium. Nowhere could an intimate relation between the lymph and bloodvessels be detected.

No additional light was obtained by the examination of ovaries from the newborn and aged. In general the lymphatics of the ovary presented throughout the same capillary arrangement. A direct communication between these and the connective tissue and interspaces could not be proved. Neither in the human ovary nor in those of animals could it be shown that the bloodvessels entered lymph spaces. The theory of perithelia in the ovary must therefore be abandoned.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

EDWARD JACKSON, A.M., M.D., of DENVER, COLORADO,

AND

T. B. SCHNEIDEMAN, A.M., M.D., PROFESSOR OF DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC.

The Relation and Treatment of Follicular Conjunctivitis and Trachoma.—Alger, New York (*Medical Record*, January 24, 1903), calls attention to the relation between these two diseases—a matter of renewed importance now that the Government is excluding immigrants suffering from contagious eye diseases, and children similarly afflicted are being excluded from the schools.

The differential points in the diagnosis between follicular conjunctivitis and early trachoma given by most writers are absolutely useless for clinical purposes, and the confusion between these two diseases is readily explicable. Trachoma is rare among children. Most of those who are excluded from the schools for supposed trachoma do not have it, but a comparatively insignificant disease which threatens no serious mischief, and which recovers almost of itself. Follicular conjunctivitis is simply reaction to local irritation, which may be chemical, mechanical, or bacterial in its nature. The subjective symptoms are almost nil. If the lids be everted, small, round granules not larger than pinheads, arranged in parallel rows, like beads, are found upon the membrane adhering to the lids. In the looser tissue of the fornix they are much larger, resembling frog-spawn or grains of boiled sago. So far as these granulations go, the appearances are the same in trachoma. A diagnosis based thereon is mere guesswork. The essential feature of trachoma is hypertrophy of the conjunctiva. Upon this we must depend for the diagnosis until bacteriology finds a specific cause for trachoma, or the cornea begins to show characteristic involvement, pannus, etc., and the fibrotarsus of the lids becomes destroyed or distorted, giving rise to entropion, ectropion, etc. Trachoma is certainly a contagious discasc. Its subjective symptoms are marked photophobia, feeling of sand in the eyes, purulent discharge, etc. In the treatment of simple follicular conjunctivitis the cause, as far as possible, should first be removed, whether chemical, mechanical, or bacterial. This involves frequent irrigations with a solution like boric acid, and with attention to the surroundings and physical condition of the child. The writer recommends swabbing the conjunctiva three times a week with a solution consisting of ichthyol, mxv; tr. iodi., 3j; glycerin, 3j. On alternate days an instillation of the following is made at home: Zinci sulph., gr. j; vin. opii., mviij; aquæ, f3ss. The roller forceps is a great time-saver, though some after-treatment is generally required.

The treatment of real trachoma is a very different matter. The author has used the above ichthyol mixture and has obtained results about as good as with other plans of treatment—not much better, not worse.

[This insistence upon the difference between two diseases which have certain appearances in common, but differ so greatly in gravity and results, is most timely. The sensational statements which have found their way into the newspapers as to the prevalence of trachoma among the school children in large cities, so far as they are based upon facts at all, are to be traced to the confusion into which the inspectors have fallen. The subject has been eagerly seized by the fomenters of race prejudices, with the result of adding to the burdens, already sufficiently heavy, of the defenceless poor of the large cities.—T. B. S.]

Results in One Thousand Consecutive Cataract Extractions.—MAYNARD, Calcutta (India Medical Gazette, February, 1903), in 1000 consecutive cataract extractions performed on 864 patients, of whom 136 had both eyes operated, obtained good results (vision from 6/6 to 6/36) in 89 per cent.; indifferent (vision poor, but sufficient to enable the patients to go about alone) in 5.7 per cent.; failures in 4.5 per cent. Of the failures 3.6 per cent. were due to sepsis, the others to intraocular hemorrhage, iritis in two cases,

iridocyclitis in one, and detached retina in one. Of these 45 failures 26 had been done with iridectomy and 19 without. The indifferent results (5.7 per cent.) were due to various causes, such as sepsis, opaque cortex, iritis, glaucoma, overripeness, mercurial cloudiness, vitreous prolapse, and so on. Of 351 patients from whom family histories were obtained, in 84, or nearly 24 per cent., parents and other relatives had had cataract. Diabetes was present in only 6 cases; all of these did well. The author does not believe in the connection between diabetes, which is very common in Bengal, and cataract. In 814 cases the average age was under fifty-three years—somewhat higher in males than with females—thus agreeing in the general belief that cataract comes on earlier in the tropics.

One hundred and eleven unripe cataracts were extracted, with 93 good, 9 indifferent, and 8 bad results (this leaves one unaccounted for). Sixty-three overripe lenses were extracted, with 57 good, 5 indifferent, and 7 bad results. Fourteen of these had prolapse of vitreous, 2 suppuration, and 1 each was lost from intraocular hemorrhage and retinal detachment. Tension was increased in 41 cases; of these 32 gave good results, 5 indifferent, and 4 bad. Tension was diminished in 90 cases; of these 77 gave good results, 8 indifferent, 4 bad, and 1 unknown. Vitreous prolapse occurred twice where tension was raised and six times where it was lowered. In no case was the tension altered beyond + or - 1.

Chloroform was used in 8 cases, cocaine in 910, and eucaine in 82. Eucaine was given up on account of the pain and increased hemorrhage it causes; otherwise it is an ideal anæsthetic.

The patients were prepared for operation by washing the face, forehead, and eyelids with soap and water, and then with sublimate solution (1 in 5000) the day before the operation. The eyelashes were cut and the conjunctival sac washed out with sublimate and a bandage applied. On the morning of the operation this procedure was repeated. In the last series the sublimate was replaced by biniodide, 1:10,000, with improvement as regards sepsis. The instruments were boiled and the dressings carefully prepared in the last 700 cases, with results nearly twice as good in these as in the earlier series. Atropine was used almost always both before and after the operation.

The appearances of the lens before operation are noted in 517 cases and compared with the condition of the capsule, cortex, and nucleus after removal, with the resulting vision. Milky-white lenses were found most often to have a tough or thin capsule (117 out of 129) and a brown or yellow nucleus. These gave the best results, and are the only kind in which it is advisable to omit an iridectomy. Lenses with glistening white sectors are of the same nature, and probably develop into this kind if left. Gray uniform lenses have often a "greasy" capsule (42 out of 110); i. e., the cystitome cuts them as if scraping cold bacon. They often have a solid and glutinous cortex (21 and 46 out of 110) and generally a brown nucleus, making removal difficult, bruising the iris and requiring subsequent discission. These require a larger incision for extraction. Gray striated lenses resemble white striated lenses as regards cortex and nucleus, but their capsules are often "greasy," requiring large incisions and iridectomy, as do also brown lenses, which often have a greasy capsule and glutinous cortex as well as

cribriform lenses. These are not uniform gray lenses with transparencies and opacities giving the appearance of a veil. Black cataracts are rare, only 5 in the 1000. Their capsules were mostly "greasy" and tough. Iridectomy was done in all with resulting good vision, except in one case, in which it was only 1/60.

From measurements of the cornea and lens the lens diameter may be taken, roughly, to be a little more than two-thirds of the corneal horizontal diameter.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

SIMON FLEXNER, M.D.,
DIRECTOR OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK,

ASSISTED BY

WARFIELD T. LONGCOPE, M.D., RESIDENT PATHOLOGIST, PENNSYLVANIA HOSPITAL.

Milk and Infant Mortality in France.—A contribution to the Annales d'Hygiene Publique, September, 1902, by DRS. CH. GIRARD and F. BORDER, under this title, constitutes a terrible impeachment of the sanitary administration of French towns, in which it appears that the laws against the adulteration of milk must be absolutely dead letters. They do not hesitate to state that the milk as retailed is "not only wanting in the requisites of a passable article of food, but has undergone such countless sophistications that it has in many instances lost all alimentary value, and must be looked upon as a veritable poison." The climax seems to be reached at Lille and Roubaix, the municipal authorities of the former town admitting that the bulk of the milk sold had been passed through a separator and retained but 5 to 7 grammes of butter per litre, or, as we should say, 0.5 to 0.7 per cent. of fat. Of 694 samples examined in the municipal laboratory at Lille 20 per cent, had less than one part and 35 per cent, between one and two parts per one hundred of fat, only 16, or 2.3 per cent., being really good.

In the year 1897 or 1898 the mayor had secured the passing of a by-law fixing the standard of fat at 2.5 per cent., but it provoked violent opposition, and was soon rescinded as an abuse of power and arbitrary interference with the liberty of the individual. The inquiries carried out by our authors seem to have had the effect of "waking up" the authorities, for the regulation was revived, with the provisos that milk might be sold with 1.5 to 2.5 per cent. if distinctly labelled "lait lécrémé," and with less than 1.5 per cent. if marked "lait pauvre." As a result of the vacillation of the authorities the percentage of samples retaining the full percentage of 3.5 of fat fell from 15 to 6.6 in 1900, and rose again to 17.4 in 1901.

Drs. Girard and Border extended their inquiries into the milk-supply and infant mortality to every town of importance in the country, but met with little assistance, if not with actual obstruction from the local authorities. But the value of their statistics is greatly impaired by their adherence to the obsolete and unscientific practice of calculating the deaths of infants under one year of age on those of persons of all ages—a ratio that tells us nothing unless we know the relative numbers of the living at the respective ages.

Only in the case of Lille do we get a glimpse of the truth. There the number of births in the year 1900 was 6228, and of deaths under one year of age was 4984. Many of these, however, being those of children born in 1899, the surviving infants at the end of the year 1900 were 4766. Tuberculosis and "athrepsie," or diarrhea and wasting diseases of children, each account for 15 per cent. of the total mortality at all ages in France; while of those of infants under a year from 20 to 60 per cent. are ascribed to "athrepsie"—in other words, to improper feeding—probably the heaviest preventable infant mortality in any community claiming to be a part of the civilized world.

The Etiology of Acute Rheumatism and Allied Conditions.—Beaton and Walker (Lancet, January 31, 1903, p. 237) have isolated a micrococcus from 8 cases of acute rheumatism, 3 cases of chorea, and 4 cases of acute endocarditis in rheumatic subjects which they regard as specific in these infections. The organism resembles the streptococcus morphologically and culturally, but differs from the ordinary streptococcus inasmuch as it grows freely in filtrates of old bouillon cultures of the ordinary streptococcus of human origin. According to Marmorek this growth would rule out the ordinary streptococcus, which he has found will not grow in such filtrates. The organism when injected intravenously into rabbits gives rise to fever and wasting, monoarthritis, polyarthritis, pericarditis, endocarditis, septicæmia, and death. The writers regard their organism as identical with those described by Triboulet, Wassermann, and by Payne and Poynton.

On Active Immunization Against Plague, Cholera, and Typhoid Fever.—Beshedka (Annales Pasteur, 1902, vol. xvi. p. 918) has compared carefully the relative value of active and passive immunity in plague, cholera, and typhoid, and proposes a new method of active immunization which does away with the untoward effects of active immunization as described by Haffkine.

The inoculation of the specific antisera in the diseases mentioned will give rise to an immunity which is immediate, but very temporary, lasting only from eight to fifteen days. Inoculations with killed cultures, according to the method of Haffkine, give a lasting active immunity, but, unfortunately, is preceded by an incubation period of from one to two weeks, during which time the animal is more than usually susceptible to infection; in addition, the localized abscesses, loss of weight, and malaise make this method far from ideal in the human being.

To obviate this difficulty Calmette and Salembini injected a mixture of antiserum and killed organisms. The untoward effects are obviated, but the duration of the immunity is not greater than with the serum alone. The author has succeeded in creating an active immunity by suspending the living

eultures in the antiserum and then washing the agglutinated organisms in normal salt solution until all excess of serum is removed. Such a mixture gives no violent reaction, and at the same time an immunity is brought about which is present within twenty-four hours, and which lasts as long as the active immunity of Haffkine. The vaccines which are prepared in this manner will also retain their immunizing power for at least several months.—F. P. G.

Peritonitis in Typhoid Fever without Perforation, with a Report of One Case Caused by the Bacillus Typhosus and Another Simulating Acute Appendicitis.-YATES (American Medicine, 1903, vol. v. p. 700) discusses the subject of peritonitis in typhoid fever without perforation, and adds two such eases to the literature. The author finds from a survey of some of the extensive statistical records of typhoid fever that this complication occurs in about 1.7 per cent. of the cases. Its symptomatology does not differ from that of the perforative type. The origin of the peritonitis in some of the cases was traced to a rupture of the mesenteric glands, but in no instance did infarctions of the spleen appear to give rise to the condition. The typhoid bacillus is usually the direct cause of the peritoneal inflamma-From the author's study of his own eases he concludes that in the one fatal ease the peritonitis was caused by a direct extension of typhoid bacilli through the ulcerated intestinal wall. The deep ulcers and meteorism were thought of as predisposing factors. In certain areas thrombi were found in the vessels of the intestinal wall. Among the thrombi were some composed of agglutinated red blood corpuseles. Experiments were made to determine whether the typhoid bacillus, or the product of its growth in cultures, was eapable of agglutinating human red blood corpuseles in vitro. These experiments demonstrated definitely that the typhoid bacillus generated agglutinin which had a specific action upon human blood.

· The Agglutinating Properties of Bile.—Cantani (Zentralblatt f. Bakt. u. Parasit., 1903, Bd. xxxiii. p. 731) reports experiments made to determine the agglutinating power of bile from normal animals and from immunized animals upon different varieties of bacteria. It was found that bile from normal dogs, guinea-pigs, oxen, and rabbits did not agglutinate any of the baeteria used, among which were B. coli, B. typhi, B. influenza, staphylococci, and streptococei. Animals were inoculated with these various organisms and the bile tested for agglutination during the stage of acute infection, but it was found that at this time no agglutination occurred. If the animals recovered from their infection, the bile occasionally showed some slight power to agglutinate that particular variety of bacterium which had produced the infection. On the other hand, the bile of animals highly immunized against a specific organism was capable of agglutinating that organism rapidly and in high dilutions. The agglutinating power of the bile, however, never exceeded or even reached that of the serum. From these observations the author concludes that if the agglutinins are present in the blood serum only in small amount, they do not appear in the bile; and it is only when they occur in great quantity in the blood that they pass over into the bile itself.

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HYGIENE AND PUBLIC HEALTH.

UNDER THE CHARGE OF

CHARLES HARRINGTON, M.D.,
ASSISTANT PROFESSOR OF HYGIENE, HARVARD MEDICAL SCHOOL.

Significance of Nitrites in Water.—The opinion of a number of recent writers to the effect that the significance of nitrites in water is sometimes overrated receives additional confirmation from a study of the subject by Dienert (Révue d'Hygiène April 20, 1903), who concludes as follows: 1. Nitrites may be found in the subsoil in the absence of pollution. 2. Pollution is not always followed by the formation of nitrites. 3. It is necessary to take certain precautions in testing, for nitrites may be formed during transportation if the temperature is sufficiently high. The test should be made on the spot at the time of taking the sample. 4. Judgment of potability should not be based upon the presence of nitrites.

The Campaign Against Malaria.—It is stated by Koch (Zeitschrift für Hygiene und Infectionskrankheiten, xliii., May 22, 1903, p. 1) that when he first turned his attention to the study of malaria he soon became convinced that the best plan of campaign was to seek out the bearers of the parasite and destroy it in their systems with quinine, paying no attention to the specific mosquito; for the parasite is to be found only in the human body and the anopheles mosquito, which latter, in the absence of infected persons, cannot generate it themselves. In an experiment at Stephansort he restricted the work of eradication on these lines and with great success. Prosch (Ibidem, p. 5) conducted a similar experiment in the islands of Brioni, and the work was carried out so thoroughly that whereas, prior to the experiment, whoever came to Brióni, even for a short visit, during the fever season was almost sure to contract the disease, and this condition had been the case beyond the memory of man. At the end of two years' seeking out those who harbored the parasite and treating them continuously with quinine, the disease was practically eradicated; and 170 men who settled on the island free from the disease remained more than a year without a single seizure. Bludau (Ibidem, p. 67) carried on a similar campaign at Punta Croce, on the island of Cherso, with equally favorable results; and Vagades (Ibidem, p. 83) another in Franzfontein, German Southwest Africa, also successfully. Bludau found the parasites chiefly in children, of whom but four out of thirty-two failed to yield them. Vagades found in his first examination that 68 per cent. of the natives were infested, and in his later examinations the proportion increased to 75 per cent. Among the surrounding tribes, from 28 to 71 per cent. were found to be carriers of the parasite. After a year's work on Koch's lines a very great improvement was observed, for during the next twelve months but fifteen cases of the disease were discovered, and four of these were imported cases.

The genesis of winter ontbreaks of malaria is explained by Janeso

(Deutsches Archiv für klinische Medicin, lxxvi., p. 474), who tells of an outbreak of the æstivo-autumnal type which occurred among the attendants and patients of a hospital during winter weather, with ice and snow on the ground. Infected mosquitoes may be present in buildings even when the outside temperature is inimical to their activity, and in this particular instance the distributing agents were infected laboratory specimens which escaped from their cage and made their way to the wards and other parts of the hospital, where they bit a number of inmates, who came down with the disease. The mosquitoes were caught and examined and were found in all cases to contain the sporozoites.

Toxicity of Liqueurs.—The French Government requested the Academy of Medicine, some time ago, to make a study of the general question of the toxicity of liqueurs and to submit a list of those essential oils employed in their manufacture which may be considered as dangerous and another of those which are harmless. On March 10, 1903, the committee to whom the subject was referred, consisting of Laborde, Brouardel, Lancereaux, Cornil, Magnan, Pouchet, Motet, and Joffroy, reported their conclusions and submitted a list of oils which should be absolutely prohibited in the manufacture of drinks, because of their dangerous nature. This list included: oil of wormwood (absinthe), oil of rue, oil of gaultheria, oil of staranise, oil of hyssop, and oil of angostura. In a second list of objectionable oils, but not sufficiently objectionable to warrant absolute prohibition, are mentioned the volatile oils of clove, mace, nutmeg, peppermint, and a number of others. The Academy voted that all volatile oils, natural and artificial, and the various extractives which are incorporated with alcohol or wine, make drinks that are injurious and dangerous, the danger being due to the oils and alcohol. It calls particular attention to the danger of drinking them before meals, when their absorption is most rapid and their poisonous properties most active. It was also voted to recommend and to urge that measures be taken to diminish the sale of such drinks.

The Sanitary Significance of Tin in Foods.—As the result of extensive investigation of the subject of tin in foods, Professor K. B. Lehmann (Archiv für Hygiene, xlv., p. 88) comes to the following conclusions: 1. Acute, but usually slight, disturbances of digestion may be caused by the use of foods which contain tin in large amounts in soluble form. suspicious are old preserves containing malic and tartaric acids, if large amounts are consumed at one time. The number of cases of undoubted poisoning due to such foods is very small. 2. Ordinary canned meats and vegetables which are not acid or are only slightly acid rarely appear to cause acute poisoning; at least, in spite of the enormous use of these, no case is known. When one hears of "acute tin poisoning," one should think of spoiled food, and tin should not be blamed until all other explanations fail. 3. Cases of chronic poisoning from amounts of tin such as can be taken up on long contact (4 to 6 milligrammes per kilo and day) have never been observed. In experiments with cats, 10 to 14 milligrammes per kilo daily for a year and a half did not appear to be markedly injurious. 4. Idiosyncratic susceptibility to tin is a theoretical possibility, but proof is lacking that such exists. 5. No special

precautions appear to be necessary in the use of canned foods except with those which contain large amounts of malic acid or tartaric acid. Such should be put up in glass, porcelain, or wood. Further investigation with regard to acetic, lactic, and other acids is desirable. 6. In spite of the small danger to be anticipated from tin, it would be fortunate if a process of packing could be discovered which would effectually obviate the necessity of ingesting that metal with canned foods.

On the other hand, Dr. Patrick Manson (Journal of Tropical Medicine, October 1, 1902) asserts that in the tropics cases of peripheral neuritis have been recognized as resulting from the ingestion of tin.

Bacteriological Condition of Milk After Treatment with Borax,-Dr. A. P. F. RICHTER (Archiv für Hygiene, xliii., p. 151) has investigated the behavior of milk with borax, especially with reference to the checking of the growth of bacteria and of the coagulation of milk. He found that slight variations in the time of coagulation were due to differences in the freshness of milk and in the temperature of the place of storage, this ranging from 15° to 25° C. He succeeded in preventing coagulation permanently only after the addition of 4 per cent. of borax, but this amount of the drug caused such a disagreeable taste as to make the milk useless. His conclusions are as follows: 1. The development of bacteria seems to be furthered after a very short time, and this is due, perhaps, to the fact that the addition of borax facilitates the dissemination of colonies of bacteria. 2. The growth of oidium ·lactis is hindered considerably by borax. 3. The same is true of B. acidi lactici (Huppe) and B. acidi lactici (Günther). 4. The liquefying and other bacteria of putrefaction are not hindered in their growth by borax, but after a time they perish spontaneously. 5. In the first few days Hueppe's lactic acid bacteria are present in greatest number, especially in untreated milk, but they are succeeded later on by those of Ginther. The greatest number of colonies occurs on the second and third day. From the sixth to the eleventh day there is a considerable diminution in the number of colonies in pure milk as well as in boraxed milk. 7. The surviving cocci were almost exclusively air cocci, chiefly micrococcus candicans (Flügge).

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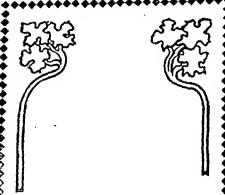
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ERRATUM.—In the October number of THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, Fig. 1, page 582, of Professor Dwight's article, entitled "An Hour-glass Stomach Observed in Situ," was wrongly placed. It should be turned so as to make the black line across the cut vertical instead of horizontal, the end on the reader's right being above.

AMERICAN JOURNAL OF THE MEDICAL SCIENCES.

NOVEMBER, 1903.

REPORT OF A CASE OF SARCOMATOSIS CUTIS, TOGETHER WITH AN ANALYTICAL STUDY OF FIFTY OTHER CASES COLLECTED FROM THE RECENT LITERATURE.

By J. C. Wilson, A.M., M.D., and Frederick J. Kalteyer, M.D., of philadelphia.

THE following case observed in the medical service of the Jefferson Medical College Hospital during the past winter is placed upon record, because it illustrates one of the varieties of disseminated malignant disease involving alike the viscera and the skin. The opportunities for the clinical study of this disease during part of its course and for the investigation of the cutaneous lesions were ample, but circumstances rendered a post-mortem examination impracticable:

Pigmented mole upon the forehead; rapid growth after injury, with great vascularity; removal by operation, followed by the formation of a normal scar; the appearance about the time of the operation and shortly afterward of disseminated nodules in the skin and subcutaneous tissues; rapid irregular enlargement of the liver; enlargement of the spleen; rapid wasting; fatal termination.

Mrs. M. B., aged twenty-six years; occupation, housewife; birth-place and residence, Pennsylvania.; admitted into the Jefferson Medical College Hospital, December 27, 1902; discharged January 13, 1903.

Family History. The patient's mother, father, four sisters, and one brother have been in excellent health. Two paternal aunts died of consumption. Some years ago her father suffered from a tumor of the face situated just beneath the eye, which was successfully removed by operation, and subsequently manifested no signs of recurrence. The patient could give no further details concerning this growth.

Personal History. During childhood the patient had measles, chickenpox, and whooping cough, and since these illnesses, until the present trouble began, she enjoyed fairly robust health. Menstruation was established at the age of seventeen years; the periods, which lasted from four to nine days, have always been irregular and painful. On December 6, 1901, she was married, and in May, 1902, gave birth to a child after a difficult labor. There was laceration of the perineum, which was immediately repaired. The child, which was fed upon the breast until a few weeks prior to the patient's admission into the hospital, ap-

peared to be healthy.

Since childhood the patient had a small pigmented mole on her fore-It was injured during the spring of 1901, by a blow against a hard object, producing slight contusion of the mole and the circumjacent tissues, but as the injury only caused temporary discomfort the incident attracted no special attention. A short time afterward the mole began to grow rapidly; it became exceedingly vascular, and on numerous occasions it bled; sometimes after a slight jar of the head or by rubbing of the forehead. On one occasion an attack of vomiting brought on a profuse hemorrhage from its surface. The tumor was dark purple, of soft texture, pediculated, hung over the left eyebrow, and measured 5 or 6 cm. in its longest diameter. Early in June 1902, it was excised. Healing was slow and at this time there was some evidence of recurrence in thé granulating wound, which disappeared after the application of some caustic preparation. A small nodule made its appearance just in front of the tragus of the left ear before the primary growth was removed. During August, 1902, she complained of pain referred to the left side of the abdomen and lower thorax, and later of pain in the opposite side, where it was constant and severe at the time of admission to the hospital. The illness progressed rapidly, and for the greater part of the two months prior to admission she was confined to her bed on account of general weakness. During this period her appetite was greatly impaired, she often vomited after taking food, her bowels were constipated, and she lost at least twenty-five pounds in weight. For a few weeks prior to her admission she was unable to urinate, which necessitated the use of the catheter.

About ten days before entering the hospital a number of small nodules appeared over the surface of the body; some were confined to the skin, some to the subcutaneous tissues, while others were more deeply

situated.

Physical Examination. The patient presented signs of extreme emaciation. The skeletal development was normal. She was exceedingly nervous, a condition which, under observation, was subsequently found to be due to a craving for opium. The fact that she was in the habit of taking opium was not known to the patient or the attending physicians of the hospital for several days. She became quite comfortable upon the administration of heroin, the nervousness disappearing almost entirely.

On the left side of her forehead, 3 cm. above and nearly parallel with the eyebrow, there was an elongated, slightly depressed reddened scar about 4 cm. in length, marking the site from which the original growth was removed. There were scattered irregularly over the surface of the body, hemispherical, oval, and roundish nodules, varying in diameter from a few millimetres to a centimetre (a few exceeded this size), situated cutaneously or embedded in the subcutaneous tissues with freely movable skin over them. These tumors were slightly tender to

the touch, of rather firm consistence, and presented no evidences of inflammation. Twenty-five nodules were found on the anterior surface of the thorax and abdomen, this being the area of densest distribution. The back, neck, and extremities showed numerous nodules, and a few were present upon the face. Over the seventh rib posteriorly on the left side a neoplasm was found attached to the periosteum, and over the ensiform cartilage there was a large nodule, the skin over which showed slight bluish discoloration. (Fig. 1.)

Fig. 1.



Disseminated sarcomatous nodules of the skin.

The liver was irregularly enlarged and tender; its lower margin extended to about four fingers' breadth below the costal arch in the right midelavicular line; its anterior surface was markedly uneven. The hepatic enlargement produced broadening of the base of the chest and marked abdominal distention, the right hypochondriac and epigastric regions being especially prominent. The rise and fall of the liver

on inspiration and expiration could be plainly made out through the thin abdominal wall, and stomach peristalsis was also visible. The spleen was somewhat enlarged. The axillary and cervical lymphatic claims were not palpable, but the inguinal glands were slightly enlarged. The heart and lungs appeared normal.

A urine examination made on December 29, 1902, gave the following results: Quantity in twenty-four hours, 570 c.c.; color, amber; transparency, clear; specific gravity, 1020; reaction, acid; urea, 2.2 per cent.; albumin, a trace present; sugar, not present; melanin,

present.

Microscopic Examination. Amorphous urates and squamous epi-

thelium.

A blood examination made on December 29, 1902 showed: erythrocytes, 4,490,000 per c.mm.; leucocytes, 2800 per c.mm.; hæmoglobin, 90 per cent.; color index, 1.0 per cent. Differential count: polynuclear neutrophiles, 90 per cent.; large lymphocytes, 1 per cent.; small

lymphocytes, 7 per cent.; eosinophiles, 2 per cent.

On admission irritability of the stomach was a prominent symptom; the patient vomited frequently after taking nourishment or medicines, therefore, feeding by the mouth was discontinued and nutritive enemata consisting of an egg, peptonized milk and whiskey, were given three times daily. With this treatment the vomiting subsided and the patient was subsequently fed by the mouth. One grain of sodium cacodylate and one-twelfth of a grain of heroin were administered by the mouth three times a day. The patient was catheterized at eighthour intervals.

On December 31st the patient's consent was obtained to the removal of one of the nodules for microscopic study; a small tumor of the skin of the left thigh was excised. This growth was rather firmly attached to the fascia covering the muscle; it was soft and had a dark bluish color.

Report of the Histological Examination of the Tumor.

The tumor excised from the leg was examined in the laboratories of the Jefferson Medical College Hospital by Professor Coplin. The fol-

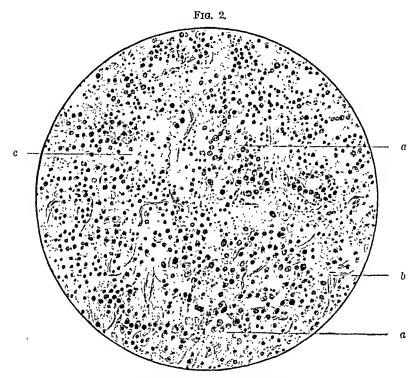
lowing is an abstract of his report:

The specimen submitted for examination consisted of two small, irregularly ovoid fragments of soft tissue, grayish-pink in color, measuring, respectively, 0.5 cm. by 6 cm. by 3 cm. by 4 cm. They were fixed in a saturated alcoholic solution of bichloride of mercury, dehydrated and hardened in alcohol, infiltrated and embedded in paraffin and sectioned. The sections were stained by the usual laboratory methods.

(Fig. 2.)
Histologically, the sections consisted almost entirely of cells with a small amount of intercellular reticulum of fibrillated connective tissuc. The cellular elements varied greatly in size; the smallest measuring from 6μ to 8μ , and the largest from 18μ to 20μ . All intermediate gradations were observed. The shape of the cells also varied—some were oat-shaped, a few were spindle formed, but most of them spheroidal. Some of the cells had a relatively large nucleus bounded by a faintly staining or extremely narrow zone of protoplasm, which in many instances was granular.

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With respect to the tinctorial peculiarities of the cells, some of the nuclei stained intensely, almost black; such nuclei, when not showing mitoses, were usually tinged uniformly. Other nuclei reacted faintly, the chromatin appearing fragmented or dotted here and there, inside of what appeared to be a nuclear membrane. Many of the cells exhibited mitotic figures; the greater number of these were atypical. The periphery of the perinuclear protoplasm of many of the cells was indefinitely outlined.



Section of tumor. Report No. 2053. a a. Blood channels walled by tumor cells and containing a few erythrocytes. b. Small strands of connective tissue; similar fibroids are scattered irregularly throughout the field. c. Pigment granules; other particles of pigment can be seen between the cells at a number of points. The extreme variations in size, shape, and relation between uuclear and protoplasmic bulk and differences in tinctorial reaction are conspicuous throughout the section.

Fine, irregular, yellow and yellowish-brown granules were scattered here and there throughout the sections examined. The distribution of this pigment was so inconstant that no effort was made to determine its microchemical character. Mast-cells were not present in the tumor, but were found in a narrow, irregular zone of fat bordering one of the margins of the tumor. The periphery of the tumor could be outlined with a fair degree of sharpness; in some areas crowding of the cells and adjacent structures was a conspicuous feature, but at no point was there any indication of a tumor capsule.

There were distributed throughout the cell mass numerous spaces lined with tumor cells; which evidently represent the channels through which the neoplasm received its blood supply.

Diagnosis. Spindle-cell sarcoma.

On January 4th (eight days after admission) at least a dozen new nodules had made their appearance over the abdomen, and about five or six on the back.

On January 10th hepatic dulness extended downward in the right midclavicular line to a point one finger's breadth below the level of the umbilicus, and in the median line to the umbilicus. Tenderness over the liver had increased. The spleen had increased in size, its dulness extending two fingers' breadth below the edge of the ribs. Slight impairment of pulmonary resonance was elicited below the left clavicle.

On January 13th the patient returned to her home. A communication received from her physician stated that she died on February 24th.

After returning to her home the disease made rapid progress; the liver continued to enlarge; there was a great increase in the number of nodules over the body; ædema of the extremities showed itself, and, just prior to her death, the lower extremities became paralyzed. The physician also noted that some of the tumors ulcerated and a few disappeared.

The malignant melanotic growths arising from pigmented moles or nævi were considered by all writers as sarcomatous, until Unna, in 1892, disputed this view and claimed that they were of epithelial origin. Unna maintains that pigmented tumors springing from nævi are of epithelial origin, and that the nævus cells are really epithelial cells, which during the embryonic period or in the first year of life are snared off from the epidermis. The researches of Gilchrist, Waelsch, Kromayer, and others confirm this view. Many pathologists, among whom may be mentioned Bauer, Green, Hansemann, Ribbert, and Lubarsch, do not support Unna's contentions, and most systematic writers on dermatology, while seemingly in favor of accepting the conclusion of Unna, still classify these neoplasms under the general heading of sarcomatosis cutis. From the clinical standpoint, however, this form of malignant disease is practically identical with the generalized melanotic sarcoma springing from the choroid. Recently Johnston reported an interesting case of perithelial sarcoma of the armpit, followed by disseminated growths in different parts of the body, which developed after injury of the forearm at the site of a pigmented nævus. This author writes that "it is not safe to generalize to the extent of saying that all neoplasms arising from nævi are carcinomata." This mooted question remains a problem for future research.

Our case undoubtedly belongs to the so-called generalized melanotic sarcoma, or to the so-called nævocarcinoma, although the almost complete absence of discoloration of the skin overlying the nodules, and the scanty distribution of melanotic pigment in the tumor examined, suggest that it approaches a border-line type between the generalized melanotic and the generalized non-pigmented sarcomata. The clinical aspects of the case are typical of those described in the literature as generalized sarcoma, in which malignancy follows a nævus tumor.

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The interest this case aroused suggested a review of cases in the recent literature described under the general designation of a multiple sarcoma of the skin, and the results of this investigation form a part of this communication. These cases have been analyzed and tabulated, with the view of determining the relative frequency of the different varieties and to ascertain some of the clinical features in a series of fifty cases. The wide range of their clinical manifestations, the variations from the generally recognized typical types, which are by no means infrequent, their obscure etiology, and the complex and diverse pathological views entertained by different authorities on the subject of sarcomatosis cutis, render classification most difficult. The cases have been arranged in the following three groups: (1) multiple melanotic sarcomata; (2) multiple non-pigmented sarcomata; and (3) multiple, pigmented, hemorrhagic sarcomata.

Twenty-six per cent. of the cases belong to the group of multiple melanotic sarcomata of the skin, 26 per cent. to the second group, the multiple non-pigmented sarcomata, and 48 per cent. to the third group, multiple, pigmented, hemorrhagic sarcomata.

In the melanotic group the youngest subject, in which the age was reported, was twenty-one years, the oldest sixty-five years, and the average forty-three years and nine months. Sex does not appear to have any marked predisposing influence; males were attacked more often than females in the proportion of about six to four. With respect to the situation of the primary growth, no part of the body seems especially susceptible. Of great interest, however, is the fact that in 69 per cent. of the cases the primary growth had its origin in a mole or nævus, and in some of these traumatism of the mole seemed to act as an exciting Eves recently analyzed the record of melanosarcoma in the London Hospital during a period of twenty years and found 45 cases, of which 33 occurred in the skin; out of this number 26 began in pigmented moles, and he points out that in a few cases a history of irritation by scratching of a mole was obtained. In our tabulated cases of melanotic sarcoma mention is made of enlargement of the lymphatic nodules in six cases, or in about 46 per cent. The prognosis of multiple melanotic tumors of the skin is highly unfavorable, and the duration of the disease comparatively short. It was impossible to determine the exact length from the histories of the cases studied, as many were reported during the progress of the illness; the shortest course was measured by a period of weeks, while in the longest duration death occurred after a period of ten years; the average duration slightly exceeded three years. Eves found the average duration of life in melanoma in his series between two and three years, and sometimes prolonged as long as ten years.

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Remarks.		Tumors grew rapidly; lymphocytosis present.	Incentation of rabblis with tumors excised at autopsy did not produce sarcoma	nor pigmentation of skin. Author holds that tumor was of epithellin origin belonging to melanotle earelnomata,	Author holds that tumor was of epithellal origin belonging to melanotie			
Treatment.	Amputation of the foot,		Primary tu-		:	Fowler's solu- tion had no influence on courso of dis- ease; excision of primary growth was	recurrence.	
Termination. Treatment.	Death.		Death.	Unfavorable course.		Death,		
Daration.	About a year and a half.	Lymphatle Over eight glands of weeks. neek and groin en-	Over a year.			About six years and a balf.	Ten years.	
Lymphatic glands.		Lymphatle glands of neek and groin en-	wrged.	ຫ≘ o~	pnaucs. Inguinal Iymphatle glands en-	inged. No glundn- lar enlarge- ment.		
Metastasis,	Two nodules in the skin near eleatrix; internal organs involved.	Left half of the lower law; liver enlarged; many nodules over wholo body in akin and subcutancous tissues.	Nearly all organs involved, (Uniform brownish-black pig- mentation of the skin.)	Metastasis to the skin near-growth.	Skln of trunk and extremities.	Methathas to the skin and sub- eutaneous tissues of the legs, arms, and trunk; hend, neek, and mucous membranes of eyes, mouth, and nose wero normal; some of the growths ulcerated.	Secondary tumors formed around primary growth.	Metastatic deposits of varying size, and some showing taker-takin, developed in different parts of the body; nodules vero greatly discolored.
Primary seat,	Right foot, from a mole.	Serotum.	Neek, from pigmented mole.	Over right shoulder- blade, from a mole.	Abdomen, from 11 mole.	Tumor spraug from plgmented mole on right foot.	Chest, from a pigmented mole.	Over right shoulder- blade.
Dingnosls.	Melanosar- coma.	Multiple melanotio sarcoma.	Melanotie sarcoma.	Melanotie sarcoma.	Melanotie sarcoma,	Melano- earcinoma,	Melano- sareoma.	Sarcoma with mel- anotte pig- mentation.
Age and sex.	F. 20:	 8	i'i	5.53	% S.	N. 65	He.	i
Reporter.	G, S. Whiteside	A. H. Tubby	Hensen and Noike	Waciseh	Waelsch	T, C. Gllehrist	Waelsch	Ludwig Merk
No.		C1	**		ıo	o	1~	95

	Author states that brain contained many tumors, but that during life there were no sensory or motor symptoms.			
		Arsenic and potassium iodide had no influence	Opium, arsenic, and bismuth.	
After excisi'n of primary tumorpatient developed general mel-anosis; death occurred 3 months after operation.		Death from septicæmia following extirpation of some of the nodules.	Death.	
Over a year.	Short dura- tion.	About five years.	Sixteen months.	Over a year.
		Enlarge- ment of lymphatic glands near primary growth.		Cervical lymphatic glands enlarged.
Many tumors in the skin near primary growth.	From a mole, Every organ contained sar- comatous nodules.	Multiple tumor formation in skin and subcutaneous tissues in many parts of the body; tumors had an alveolar artangement; some of the cells contained melanin.	from Skin, abdomen, and subcuta- ted neous tissues: sarcoma cells found in the kidneys, mesen- teric glands, but none in the liver or spieen.	Left inguinal Neoplasms appeared over many gland en- gland en- gland en- gland en- gland en- glack dy's yr. distribution upon feet and ago, and 1 yr. forcarms: face, extremities, before date of report lips and mucous membranes of of report lish and mouth show brown- nodules ish discoloration; spleen en- right buttock.
Back.	From a mole.	Over right shoulder- blade, from a mole.	Left loin from pigmented nævus.	Left inguinal gland en- larged 4½7rs. ago, and 1 yr. before date of report nodules formed over right buttock.
Melanotic sarcoma.	Dissemi- nated sar- coma.	General melanotic sarcoma.	Nævosar- coma, fusi cellulari.	Melano- sarcoma, multiplex cutis,
56 50	Ŧ.	M.	F.	57.
9 Bark	Bozzolo	U. A. Minie	Glovanni Pini	Rona.
6	10	Ħ	12	133

HILSON, KALTEYER:	TOOMATOSIS CUTIS.	
Remarks.	Author regards skin as primary scat. Author regards his ease as hetumors, citio group of sarcoid tumors, centrence occurred rapidly; histological scentred sarcoma; a threefold templant, leucoeytosis present.	comming suggests that the servential of the order of the bloodvessels.
Treatment. Powfer's sol. Powfer's sol. In ascending ascending by marked improvement disappeared, but ofters but ofters but ofters ascendent did not eleck disappeared flower treatment flower treatment did not eleck disappeared flower treatment did not eleck did not eleck disappear	Injections of streptococcie cultures did not benefit patient. MACOCCIONATION OF STREET STREE	A veni
SARCOMATA, utlon, Terminor, ort, Death from diplutho, d ria, in n n n tra n n tra n n n n ria, n n n n n n n n n n n n n	Death, In St.	-
TGMENTED SAR. Lymph- ntte glands, Brort, flefal auto flands flangs flang		
VON-PIGMEN Lymph Lymph ntte glands, flood sons lymph ntte flood tric flood inte flo		
Seat. Seat. Mclastasis. Mclastasis. Mclastasis. Mclastasis. Mclastasis. Lymph- nutic glands. Glands. Mclastasis. Lymph- nutic normal	About 100 nodules over the usefuce of the bedy, also me-cuteffe glands, exophagus, and intestine. Rights, exophagus, Numerous small nodules developed in the primary growth; internal the primary growth; internal Entire surface of body covtromers with small white tumors grow rapidly in four tumors grow rapidly in four notthe child's general health.	
Trimor on check spiror on chec	Non-painful Al tumor In cpl. 18 gustric region 10 cc ou tumor In cpl. 18 gustric region 10 cc ou tumor International Committee 10 cc ou tumor Internationa	
Generalize non-pipelized non-p	- 1 20 H :	
N. 52 33 33 34 11 1 1 1 1 1 1 1 1 1 1 1 1 1 1	M. S.	
No. Reporter. H. Ransohoff 16 M. Kaposi 17 Stranss 18 Max Joseph	Spiegier Karewsky	

For a few days About 100 nodules scattered pills of arsenic over body, some in the skin, and hænoglo- others in the subcutaneous bin. tissues; all were covered with normal skin.	Author divides the disease into two stages: the first of 2 mos. duration, during which multiple-skin sarcoma developed (small round-cell sarcoma); the second period lasted 2% weeks, in which the skin affection was not the conspicuous feature, but there was marked dever, hemorrhages, voniting, diarrhea, nephritis, and then lobar pneumonia. He regards the latter part of the disease	as a septic manifestation. Author states that the tumor was rich in cells showing an alveolar arrangement and histologically represented a border-line between sarcoma and	carcinoma.	Internal organs normal. Author regards prognosis as favorable.	Author states that it is not safe to generalize to the extent of saying that all neoplasms arising from nævi are carcinomatous.
For a few days pills of arsenic and hæmoglo-bin.	Bismuth sub- nitrate for gas- trointestinal disturbance; arsenic and morphine.	Tumor excised twice, each time rapidly re-forming.		Arsenical treatment.	
	Death; disease disease groop groop groop rapidly.		Death.	Favor- able.	
			Short.	Six years.	About two years.
	Inguinal glands enlarged.				Axillary lymph- attc glands enlarged.
Numerous nodules developed upon the skin; the upper lip contained a nodule; internal organs were normal.	Autopsy revealed new growths in the skin and subcutaneous tissues, biceps muscle, ingunal glands, liver, stomach, small and large intestines.	Tumors developed in the skin and subcutaneous tissues of trunk and of the left axilla.	Skin and internal organs; at first metastatic growths rapid- Iy formed in the skin of buttocks and extremities, which in the course of 2 weeks disappeared almost completely; later, however, disseminated nodules developed in the skin and the faternal course.	Disseminated nodules in the skin over entire body, also in subcutaneous tissues.	Sarconatosis Arm; from pig- bisseminated nodules in the cutis, perimented mole; skin over whole body; two of tbeliaf sar- patient injured these nodules on examinathe street forces the forearm at thon were found to be fibrothe street of a mata; tumor in abdomen. In site of a mata; tumor in abdomen. pigmented havyus, 2 years before coming under observation; 2 months later tumor developed in armpit, and 10 months later neoplasms formed on the arm.
Loin.	Abdomen; a number of nodules appeared upon the abdomen.	Upon back in dorsal region in median line.		First nodule between shoulders, then tumors develooped near site of primary	Arm; from pig- mented mole; patient injured the forearm at the site of a pigmented neavus, 2 years tion; 2 months pit, and 10 mon the arm.
Multiple non- pigmented skin sarcoma.	Multiple skin sarcoma.	Alveolar sar- coma.	Lympbosar- coma,	Round-cell sarcoma.	Sarcomatosis cutis, peri- tbolial sar- coma.
M. 64.	r: g	M. 38		F.	; *
Rille	W.W.Iwanoff	Kriebick .	Kaposi	Krulle	Johnston
.21	25,	R	75	25	56

GROUP III. -- MULTIPLE PIGMENTED HEMORRHAGIC SARCONATA.

-			were i the hilpie lithie larly e are olog- olog- illpie inpie on- olog-	rufti- ssum	na of neys, tnes.	from
	Кетагкя.		All the tissues of the foot were involved by the sarcoma; the gutbor pellees tills case in the group of idiopathic multiple pigmented sarcoma of the siden. This case is particularly interesting because there are certain points of difference in both the cillicat and pathological aspects from the type described by Kaposi (multiple pigment sarcoma). The nodiles showed a tendency to infiltrate the tissues; the lympin easted. He surgests the none of the sarcoma.	sarcoma idiopathicum multi- piex en piaques pigmentosum et lymphangicetodes.	Autopsy revealed eareinoma of the lungs, liver, kidneys, spieen, and serous membranes.	Hemorthages occurred the lungs and note,
-	Treatment.	Ascending doses of arsenie with progressivolm.	provement. Recovery.		:	Under arsenical treatment some of the nodules disap- peared.
	Termina- tion.		Hypoder- mie injec- tions of arsenle were first given, inter arsenle in pill form without influeneing local dis- ense; am- putation of foot.			
	Duration.	;	Seven or eight years.	viandaplikings till paper i ri	Two years.	Flve years.
	Lymphatie glands.		Left inguinal gfanda silghity enlarged.	-		
	Motnatnaja.	Left foot.	Mensuals to the left leg, lissues about the knee-joint; skin and other parts of the body normal; atrophy of the muscles of the left leg; bones of the foot are nor affecte; internal organs normal.			Upon the hands and other parts of the body.
	Primary seat.	The of fingers of the left hand,	Left foot.	Handsand feet.		Sarconna, Sarconna, Bultplex Inemortangio pigmentosum discolorition of solo of foot; in- duration, swell- ing, and discol- omtion devel- oped.
-	Diagnosis.	Hemorrhagie Th sarcoma. of th	Sarcoma idiopathi- cum multi- plox,	Idlopathic multiple pig- ment sar-	Multiplo Idlopathic sarcoma of	Sarconna, multiplex, pigmentosum
	Sex and age.	7,12	M. 255	M. 48	7;R	M. 58
	Reporter.	Unna	Robert Bernhardt	Spiegler	Phillppson	Kaposl
	No.	13	8	23	30	ឌ

Microscopic diagnosis—sarcoma,	Microscopic examination revealed a spindle cell sarcoma.	Marked increase in the leuco- cytes involving particularly the mononuclear forms.	Internal organs normal. Microscopic examination revealed a pigment sarcoma composed of spindle-cells and some oval and round cells; the tumor was very vascurar.	Internal organs normal.	The tumors were soft and vascular; histologically, growths in many respects resembled au iuflammatory swelling.
Arsenical treatment had no effect upon the disease.	Arsenic hypoder- mically.				Arsenic appeared to have no effect.
Favorable course fol- lowed am- putation of foot.	-				
Five years.	Over two years.			Over two years.	Over two years.
			Left inguinal giands enlarged.	Not en- larged.	
Upon both feet, Developed upon hand and other parts of the body, upper and lower extremities, mucous membrane of the gums, also involved bones of foot.			Left foot and hand, then upon various parts of the upper and lower extremities, also nod- ules on the trunk; tumors yellowisb-red in color, firm, and varied in size from that of a pinhead to that of a hen's	egg. Bright red nodules developed on the ankles; palate also involved,	Left hand, feet, and other parts of extremities became involved; right hand and arm not involved.
Upon both feet.	Upon extremities, particularly upon the fingers and toes.	:	Radial side of left hand; onset marked by reddening and thickening of the skiu.	Upon the feet; I tumor formation preceded by discoloration and thickening of the skin.	Two years before patient came under observation dark purple discoloration of skin of inner side of peared; later tumors developed in this region and at same time an eruption appeared upon left hand.
Multiple idiopathic skin sarcoma.	Multiple idiopathic pigmented sarcoma (Kaposi.)	Multiple idiopathic sarcoma, (Kaposi.)	Pigment sar- coma.	Angiosar- coma.	Multiple pigmented sarcoma.
ž.	M. 65	:	52.	M. 50	M. 655
Scholtz	Lustgarten	G. Dieballa	Robert Bcrnhardt	Robert Bernhardt	Sequeira
32	88 .	34	35	ဗ္ဗ	32

	Remarks,	Internal organs normal.	Author points out that this form of surcona may pursue a favorable course and the tunors decease in size, leaving attophed areas of skin; the internal organisare exceptionally involved; the diliferential dilay involved; the diliferential diagnosis between this variety and the more malignant forms much the more malignant forms and the more malignant forms and the more painted.	differences are slight. Tuberculin injections failed to give a local or general re- action.		Internal organs normal; histologically tumor found to be a vascular small round-cell surcoma; author suggests the possibility of an intectious	origin.	Nodufes situated upon discolored skin; some nodules uleerated; internal organs normal.
	Termina- Treatment. tion.	Arsenic,		Arsenic injections.				Right foot was ampu- tated.
	Termina- tion.	Marked im- provement; disappear- ance of some of the	nodries.	Improved after short course of treatment.				
	Duration.	Over one year.		Over one year.	Over two years,			Five or slx years.
	Lymphatic glands.	Glandular enlarge- ment ab- sent.				Lymphatle glands enlarged.		Ingulnal lymphatic glands enlarged.
	Metastasis.	Upon the arms.		Other parts of the body; tu- mors showed reddish discol- oration.	Nodules upon both hands and lower extremities; reddish discoloration with induration,	Developed In a Upon the leg, then upon the scar upon foot. opposite limb, and later upon upper extremities.		Upon the left foot, then upon the hands.
	Primary seat.	Small soft tu- mors simul- taneously de- veloped upon both hands.	Skin of upper and lower ex- tremities con- tremities con- faire modules.	Lest check.	Sarcomn entils On back of left 18 Idlopathicus hand; bluish- red discoloration of band.	Developed in a scar upon foot,		Right foot.
	Diagnosis.	Multiplo sarcoma of the skin.	Multhle diopuble sarcoma. (Kaposi.)	Hæmanglo- sarcoma cutis.	Sareoma entis Idiopathieus multiplex.	Generalized hemorrhagie sareoma,	Idiopathle multiple sarcoma.	Spindle-cell sarcoma.
	Sex and age.	12.	:	¥¤	7.82	M.	:	76. 25.
	Reporter.	Gustav Tandler	Splegler	Wolters	Kaposí	Antonio Stravino	A. Roth	Robert Bernbardt
Ì	No.	88	ee	Ė	#	23	8	#

W	ILSUN,	KALTEYER: SARCOMATO			
	Some nodules ulcerated; internal organs normal; illness progressive, some nodules increased in size and new ones formed.	Skin in the involved areas showed bluish discoloration; during course of disease patient became emaciated.		Histological examination revealed a sarcoma.	Prolonged Neoplasms atrophied and sole- treatment rotic changes developed; the with cells of the new-growth were arsenic of epithelioid connective-tis- and cod- liver oil. the sarcomatous type were present.
				Arsenic without effect,	Prolonged treatment with arsenic and cod- liver oil.
				Death.	Recovery considered complete by the author.
Exactonset not known; duration estimated as being five years.			Five years.		About seven years.
	Cervical and sub- maxillary glands enlarged.			Lymphatic glands enlarged.	Enlarge- ment of many chains of lymphatic glands.
feet, Upon the extremities, penis, and scrotum.	Upon feet and left leg.	Upon right leg, left foot, and hands.	Left and right foot, also left upper eyelids; skin of involved area thickened, indurated, and discolored.	Sarcomatosis Numerous nod-Scrotum and shoulder, ules of a brown. ish-red color upon left calf.	Spread to face, trunk, arms, forearms, thighs, and legs; nodules varied in size from that of a pinhead to that of a bean, were rather firm; some had a bluish tint and showed slight umbilication.
Handsaud	Head.	Right foot.	Left hand.	Numerous nod- ules of a brown- ish-red color upon left calf.	On forehead.
Multiple Hands aud hemorrhagic sarcoma.	Multiple hemorrhagic sarcoma.	Multiple hemorrhagic sarcoma.	Multiple bemorrhagic sarcoma.	Sarcomatosis cutis.	Multiple benign sar- comatosis of the skin.
M. 86	25.	M. 69	M. 59	ಶಜ್ಞ	M. 56
45 Robert Bernhardt	Robert Bernhardt	Robert Bernhardt	Robert Bernbardt	Kaposi	C. Boeck
. 45	46	47	48	49	20

The treatment of multiple melanotic sarcoma is most unsatisfactory. Early surgical interference was practised in several of the cases studied without apparently influencing the rapid metastasis which followed, although many instances can be found in the literature which demonstrate that early excision of the primary growth is not followed by recurrence. Whiteside reported a case of melanosarcoma in a female, aged fifty years, which had its origin in a mole on the right foot, in whom amputation was performed without preventing subsequent metastasis, but he nevertheless holds that radical surgical interference should be practised early in such cases. He advances the following conclusions: (1) a mole on the foot in a middle-aged person should be excised; (2) an ulcer beginning in a mole on the foot demands immediate and radical surgery; (3) the prognosis of ulcerated moles should be guarded even where the growth seems non-malignant. Potassium iodide, arsenic, and other drugs of the so called alterative group have been tried without effect.

Inoculation experiments were unsuccessful. Hensen and Nolke inoculated rabbits with melanotic tumors excised at autopsy without subsequently producing sarcoma or pigmentation of the skin, and Gilchrist injected sterile bouillon containing fragments of a sarcomatous nodulc into a dog without causing subsequent tumor formation.

The multiple, non-pigmented variety shows variable clinical and pathological features. In the above tabulated cases the average age of the patients is between thirty-nine and forty years. A case was found in which it occurred in the newborn, and one as late as seventy-six years. Males were attacked more frequently than females in a proportion of about two to one. The primary seat in some cases was cutaneous, in others subcutaneous. In about 30 per cent. of the cases the lymphatic glands were enlarged. Nothing definite can be said of the rapidity with which metastasis develops; the internal organs were involved in some cases, while in others they were apparently healthy, with extensive cutaneous dissemination, nor can a definite opinion be formed of the duration, as in some of the cases the date of the onset could not be determined, in others the reports were made while the disease was still in progress, and in two death resulted from other causes. In some of the cases the duration of the disease was short, with a fatal issue, while in others it existed for a few years, and in one as long as six years. Regarding the treatment the administration of arsenic was, as a rule, without influence, although in a few cases this drug appeared to have a favorable effect.

The third group—multiple, pigmented, hemorrhagic sarcoma—has attracted much interest, and also represents a form of varied symptom-complex. Its pathology is even less definite than that of the other two varieties. The tumor formation usually begins upon the extremities,

and may attack the dorsal surfaces or the soles of the feet, backs or palms of the hands, then spread to other parts of the extremities, and may finally involve the trunk, face, and mucous membranes, and exceptionally the internal organs; not infrequently several parts of the body are attacked simultaneously or at short intervals. The tumors usually show bluish-red discoloration, and the circumjacent skin of the involved area is usually swollen, indurated, and discolored. In a case reported by Bernhardt the sarcomatous process involved nearly all the tissues of the foot.

The course of the disease is variable, lasting several years and sometimes prolonged as long as five years or seven years, and may ultimately end in recovery. This form of malignant disease is generally regarded by writers as sarcomatous, although many eminent dermatologists oppose this view. In a case recorded by Sequiera the histological examination in many respects resembled an inflammatory swelling, and Stravino suggests the possibility of an infectious origin. The prognosis is not so grave as in the two other forms; Bernhardt and Scholtz report cases which terminated in recovery after amputation. Treatment with arsenic appears to have a favorable influence in modifying the course of the disease, and in some cases recovery has followed. In our tabulated cases of multiple, pigmented, homorrhagic sarcoma, the average age of the patients is fifty-three years, the youngest subject being twelve years, the oldest eighty-six years. Sex seems to have a predisposing influence, as males are attacked much more frequently than females. Of twenty-one of our cases in which the sex was noted twenty were males.

In conclusion, we wish to direct attention to the great danger that a mole may take on active growth, and be transformed into a malignant tumor by traumatism at its site, such as scratching, slight contusion, or cutting, and, finally, to the importance of early radical surgical interference in those cases in which tumors spring from pigmented moles.

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UNCINARIASIS IN TEXAS.1

BY ALLEN J. SMITH, M.D., PROFESSOR OF PATHOLOGY, UNIVERSITY OF PENNSYLVANIA.

(From the Pathological Laboratory of the University of Texas, 1903, No. 6.)

Some years since the writer, interested in conse-Introductory. quence of having frequently met with various human parasites in the work of the Pathological Laboratory of the University of Texas, elicited from the venerable Ferdinand Herff, of San Antonio, in the course of a conversation concerning his experience with parasitic worms, a number of interesting data upon the subject, and later had the pleasure of inducing Dr. Herff to publish these experiences. In one of his articles,2 Dr. Herff refers to his having met certain small round worms in the intestine of a Mexican woman who had died in his care, which, at the time of the autopsy, he had regarded as young ascarides, and had neglected in consequence, but which at the time of writing he was disposed to believe, as he recalled the specimens, to have been examples of uncinaria duodenalis. In 1895 (by mistake stated 1893 in the article of Dr. M. C. Schaefer in Medical News, October 26, 1901, and quoted

Read in Section of Medicine, American Medical Association, New Orleans, 1903.

² Trans. Texas State Medical Association, 1894; Texas Medical Journal, June, 1891.

thence by Stiles and others), while demonstrating in class the microscopic features of fecal matter (obtained from the common closet of the college and supposed to be normal), the writer encountered ova which at first, from ignorance of the subject, he supposed to be those of oxyuris vermicularis, but which after further study at the time were determined as those of uncinaria duodenalis. Although what at the time was believed a reasonable effort was made to discover the host of the worms, the search was not successful. A number of times during the following years in the intestines of experiment dogs the writer came upon examples of the allied species uncinaria canina, and was inclined to believe that the prevalence of the latter could be regarded as suggesting fit conditions in the same locality for prevalence of the human species. Moreover, in several instances he had found peculiar small ecchymotic wounds in the upper part of the small intestine of human beings at autopsy, similar to those found in dogs which have been infested by hookworms, from which again the suspicion of human uncinariasis arose; and, although the worms were not found in these particular instances, this failure may easily be understood when it is stated that in the routine autopsy work the unopened intestines were formerly always handed over to a laboratory servant, to be opened and washed before examination was made of the interior appearances, under which circumstances it is quite likely that any parasites present were unnoticed and washed away. Finally, in 1901, in a case in the United States Marine Hospital Wards in St. Mary's Infirmary under the care of Acting Surgeon William Keiller, Dr. M. Charlotte Schaefer, while examining the stools for amaba coli, encountered certain bodies which she brought to the writer for identification. They were recognized as the ova of the hookworm, and after Dr. Keiller, with this knowledge in his possession, had administered a suitable dose of thymol, followed by salts, there were obtained from the discharges a few more than one hundred examples of the worm. This case¹ has been reported by Dr. Schaefer.2 Within a day or two after this discovery (the ova from this case having in the meantime been demonstrated to the medical class) the class was working over some presumably normal human fecal matter taken from the common closet of the school, when several of the students called the attention of the demonstrator in charge, Dr. William Gammon, to the existence of the same ova in this specimen, and on investigation they were found in large numbers

¹ The parasites from this case are in possession of the writer and have been identified as examples of uncinaria americana. It is of interest to add that in this case not only were the above-mentioned ova met with, but also a number of eggs of the whipworm and numerous amæbæ coli. Subsequently one male trichocephalus dispar was obtained from the stools, but no more at any time. At autopsy some months later a small, shrivelled hydatid cyst was found in the liver, and in the lungs and pericardium advanced tuberculosis.

² Trans. Texas State Medical Association, 1901; Medical News, October 26, 1901.

in a large proportion of the class preparations. After this discovery the writer posted upon the college bulletin board an announcement of the fact and its importance, indicating the particular apartment of the closet and the approximate time of the deposit of the feces therein, and asking that any of the students recalling the use of this apartment at about the stated time should communicate with him. Several persons thus applied, and microscopic examination of their passages was made, but without discovery of any of the ovn. These occurrences took place in the latter part of February, 1901. In the latter part of the following month it happened that with this positive knowledge of the existence of the parasite in the intestines of at least one or more of the students the writer noted a distinct eosinophilia in the blood of two students who, among others, applied at this time for examination for the parasite of malaria, and was led thereby to suggest examination of the stools for the possible discovery of these parasites as a complication In the feces from each of these cases (Cases I. and II.) in each case. the ova of the hookworm were found, and in the blood of the first the malarial organism was also afterward encountered by the writer; but, unfortunately, the latter gentleman almost immediately left school without notice to the writer, and the discovery of the ova was not followed by the removal of the parasites themselves. The second was, however, presently given thymol, and the worms obtained in the stools passed thereafter.

These two instances of the discovery of the hookworm in persons living practically all their lives in Texas, and hence having acquired the parasite from conditions prevailing in the State, together with the other data above mentioned, caused the writer to undertake the examination of the stools of as many of the students in the school as could be induced to submit specimens to him. It was thought that the group of medical students coming from many portions of the State would serve in an unusual degree as an index of the population of the State, and the discovery of the parasites in persons whose homes were widely distributed would establish in an unquestionable manner the prevalence of the worm as a native entozoon of this general district of the country. In the search thus undertaken the writer was materially aided by the following gentlemen, then members of the Junior Medical Class, whom he wishes here to thank for their assistance: J. J. Terrill, W. A. Allison, J. R. Elliott, D. H. Lawrence, O. H. Plant, C. D. Cantrell, and M. R. Sharp. With the co-operation of these gentlemen the writer was able, between May 7 and June 12, 1901 (the latter date being the time of finishing the final class examinations in the school and the time when the undergraduates, as a rule, left Galveston), to examine with a fair degree of care eighty-six examples of feces submitted by as many individuals (inclusive of a few previously examined by the writer).

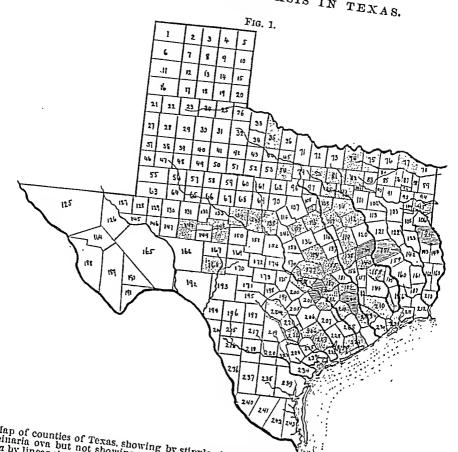
In this group of eighty-six individuals eight persons were found to be infested with hookworms; and doubtless had it been possible to have extended the search throughout the entire student body, as at first planned, in the remaining one hundred and fifty or more, other instances would have been discovered. It has been a matter of regret to the writer that he has been unable, because of imperative school duties, to supplement this original series by other investigations in the same systematic and a more thorough manner.

In addition to these, it is not improper to add at this date that several other cases have been recognized in the wards of the hospitals of Galveston by some of the colleagues of the writer, which will doubtless be published in the future, and that one case has been reported to the writer by Dr. J. S. Wooten, from Austin, Texas, and two cases by Dr. W. D. Jones, from Marshall. To date, as far as the writer is aware, these cases comprise those which have thus far been recognized from the State of Texas (from which the uncertain but probable case of Herff and the proved case of Dr. Schaefer should be excluded as being both of Mexican origin); but in the light of numerous discoveries of the parasite elsewhere in the United States, particularly following the brilliant investigations conducted by Dr. Charles Wardell Stiles,2 zoölogist of the United States Public Health and Marine Hospital Service in the Carolinas and Georgia, these findings indicate the probability of a wide and important prevalence of this zoöparasite in Texas, and also in the general district of the South Atlantic and Gulf States.

Details of the Writer's Cases. The distribution of seven of the eight cases mentioned in the present series is indicated by the linear-shaded counties in the accompanying map of Texas (Fig. 1), the stippled counties representing the home counties of those students examined but not found infected. The eighth infested individual prior to his life in Galveston as a medical student has had no permanent residence for years; was originally from the western part of Louisiana, but had been employed in various occupations at various times in Texas, Louisiana, Indian Territory, Arkansas, New Mexico, Mexico, and Colorado. For this reason his home is not indicated in the map. In all the counties indicated as the homes of persons found to be infested the observation of Stiles (sup. cit.) that the disease is especially prevalent in sandy districts is well borne out. Red River County (77) is in the greatest portion sandy, with red clay subsoil, and its water

² Bulletin 10, Hygienic Laboratory, United States Public Health and Marine Hospital Service, Washington, D. C.

¹ It may be noted as a matter of further interest that in addition to the cases of uncinaria there were encountered in this series one case of trichocephalus dispar, one of twnia mediocanellata, eighteen of amwba coli, and eight of trichomonads and other infusoria.



Map of counties of Texas, showing by stipple shading the homes of persons examined for cana by linear shading. Counters mentioned according to following list;

1. Dallam; 2. Sherman; 3. Hansford according to following list;
2. Sherman; 3. Hansford; 4. Onlitrue; 5. Lipscond; 6. Hartley; 7. Moreire; 16. Deaf Smith; 10. Hemphill; 1. Onlitrue; 5. Lipscond; 6. Hartley; 7. Moreire; 12. Deaf Smith; 11. Hemphill; 11. Onlinam; 12. Sherman; 3. Handall; 18. Online; 19. Dolley; 19. Carson; 7. Moore; 19. Parmer; 21. Carson; 24. Briscoe; 2. Hanl; 20. Holley; 20. Collingsworth; 19. Help; 30. Lycker; 31. Motley; 32. Briscoe; 23. Hanl; 26. Honley; 20. Collingsworth; 19. Help; 30. Freedram; 33. Hockley; 30. Lubbeck; 40. Crosby; 31. Blokard; 20. Collingsworth; 22. Haskell; 33. Throckmorton; 54. Torry; 46. Crosby; 31. Blokard; 20. Sher; 60. Sher; 60. Sher; 60. Shee; 61. Shee; 62. Stephen; 63. Hanl; 53. Honcekmorton; 54. Torry; 46. Crosby; 31. Blokard; 54. Sheward; 65. Fisher; 60. Shee; 61. Shackelfor loung; 55. Gallaysn; 49. Barwon; 67. Borden; 55. Solwer; 62. Stephen; 63. Andrews; 49. King; 46. Showard; 63. Shee; 61. Shackelfor loung; 65. Gallaysn; 67. Barwon; 67. Borden; 55. Solwer; 62. Stephen; 63. Andrews; 63. Hone; 64. Shee; 64. Shee; 64. Shee; 64. Shee; 65. Shee; 66. Shee; 67. Shee; 68. Torry; 69. Callahan; 69. Callahan; 69. Shee; 69. She

supply is largely from surface wells; Leon (139), Bastrop (179), Harrison (95), and Shelby (124) counties may be similarly described (the last named has a small section of black river bottom land); the extreme east and west of Houston County (141) is black river bottom, the centre sandy, with red clay subsoil; the western and southern portions of Austin County (244) are black, approaching the "black waxy" type, its Brazos River bottom land is a red loam, its centre is sandy. All these districts depend mainly on surface wells for their water supply.

The eight cases included in the present series may be outlined as follows:

CASE I .- H., male, aged twenty-two years, medical student; has resided in Shelby County (124) all his life, save that for a year he worked on the H., E. and W. Railway between Houston, Texas, and Logansport, La., and after November 15, 1900, was in Galveston in attendance upon his medical course. At his home the water supply was invariably from surface wells; during his railway service it was from various sources; surface wells, springs, and creeks; since his residence in Galveston from deep artesian wells and from overground cisterns. is no history of dirt-eating or other similar practises, and none of ground-itch. Within five years prior to the discovery of the hookworm ova in his discharges he had had no severe disease of any type beyond a number of malarial attacks, which invariably responded promptly to quinine. For about a year, however, he had noted more or less disturbance of an indefinite type in the abdomen, some irregularity of the bowel action, and slight discomfort in the upper portion of the abdomen. The patient first consulted the writer in the latter part of March, 1901, because of a malaria-like paroxysm the evening before. He was a sparely-built man, of medium height, anæmic in appearance, with a somewhat drawn, anxious expression, poor circulatory tone, no evidence of pulmonary disorder, no appreciated urinary fault, but complaining of moderate abdominal discomfort in addition to the history of the supposed malarial paroxysm. Examination of the blood at first failed to show the presence of hæmatozoa, the examination being made ten or twelve hours after the chill and the patient having had no quinine A distinct eosinophilia was, however, apparent, but in the meantime. no numerical determination of the red and white cells and no differential count of the leucocytes were made. The presence of the excess of eosinophile cells in association with the patient's appearance and with the failure to find the malarial organism in his blood led the writer to suspect that this man might be the individual from whom had been passed the hookworm ova found in the closet a few weeks previously, and a request for fecal matter was made. The following day, in a mushy, light-brown stool, the ova in question were quickly found in moderate numbers; and a second blood examination made the same day resulted in finding a few ordinary tertian malarial parasites. Quinine in large doses was administered, and the patient was urged to submit to

¹ None of the parasites having been obtained from this case the precise type is unknown, but it may be inferred that they were, as in the others of the series, examples of uncinaria americana (Stiles).

medication with thymol, with a view of ridding him of the worms. This he declined, and the malarial paroxysms persisting in spite of the quinine, he shortly, without notifying the writer, left Galveston, and has never returned. Letters from him, however, state that after some time he recovered from the malarial attacks, but that his health continues to be far from good, the abdominal disturbances being persistent.

CASE II.—S., male, aged twenty-nine years; pharmacy student; home in Leon County (139), but prior to coming to Galveston to attend school he spent some months as a logger in a saw-mill in Angelina County (142). Iu the latter employment he was constantly handling dirty logs, and at this time was often forced to drink creek and "branch" water. his home his drinking water was obtained from a surface well. Aside from the questionable water supply in Angelina County, no distinct dietetic faults were known. At no time in his life did he recall having had an eruption comparable to "ground-itch." While employed in Angelina County his health deteriorated to a marked extent; he lost not less than thirty pounds in weight, became decidedly auæmic, short-breathed, and much bothered with constipation. He had during this period no definite malarial attacks; but the day before he applied to the writer he had a severe paroxysm. At time of examination in March, 1901, he weighed about 170 pounds (probably ten or fifteen pounds less than his usual weight), was somewhat sallow, and complained of considerable malaise. Blood examination here again failed to reveal the presence of the malarial parasite; but, as in the former instance, a moderate eosinophilia was noted, and, for the same reason as in the previous case, a specimen of the patient's fecal discharge was The following day a small number of ova of the bookworm were discovered in the stool. Repeated examinations of the blood subsequently failed to show the presence of any malarial organisms; but early in the following vacation there was a second malaria-like paroxysm, after the subsidence of which the patient has remained to the present entirely free from this feature. On April 23, 1901, ninety grains of thymol were administered, with the usual precautions as to abstinence from alcoholics and oils, after a night's fasting, and followed by a dose of salts after an hour from the last dose of thymol. The stools were collected, washed through a sieve of cheese-cloth, and two female examples of the uncinaria americana (Stiles) were obtained. Owing to press of class work the writer was unable to give attention to complete blood study in the case, as was desirable, but put aside several smears for a differential leucocyte count. This latter shows an eosinophilia of 10 per cent., a marked increase of lymphocytes (40 per cent.), with a corresponding decrease in the polymorphonuclear elements (40 per cent.); large mononuclear cells, 8 per cent. There are to be seen in the specimens frequent examples of altered red cells and of polychromatia; apparently, too, judging roughly from both stained and fresh preparations of the blood there existed a distinct relative leucocytosis; but without exact method, it is, of course, unsafe to insist upon this feature.

Subsequent examination of the stools failed to exhibit the presence of more ova, and from the time of the discharge of these few worms, with the single exception of a chill and fever during the following vacation (for which quinine was at once given and which never recurred), the patient rapidly and fully regained his health and weight.

Although in this case so few of these worms were obtained that the writer has been forced to accept the idea that these could not have caused the symptoms mentioned above, yet it is to be kept in mind that possibly, by some fault in the collection or examination of the stools (which is not appreciated, however), a considerable number of the worms were Or else it may be that the few actually found represented only the remnants of what was once a more serious number in the man's intestine. It seems not impossible that there may have been originally, probably at the time of the marked loss of flesh and the anemia noted as having been present when the patient was working in Angelina County, a much greater number of the parasites than were obtained from the stools after thymol, and that the two actually found were the only ones remaining of such a really serious infection, and in this sense it is not improbable that much of the symptom-complex narrated may have been due to these parasites. At least the rapid and complete recovery of the patient's former health and vigor and the total disappearance of the abdominal discomfort after relief from these few worms would not be inharmonious with such an idea.

Case III .- G., medical student; aged twenty-one years; stockily built; sallow; a resident practically all his life in Red River County (77), working in the intervals of his school duties upon his father's farm and in a cotton gin. Three years prior to the discovery of the uncinaria ova in this case the patient had gone on a long wagon trip through the northern tier of counties of the State, west as far as Haskell County (52), thence northeast to Wilbarger County (35), thence along the Brazos River to Young County (54), and east in a somewhat tortuous route to his home—a trip of over 500 miles, during which time the water supply was uncertain and usually bad, taken from surface wells, ponds, creeks, and similar sources. At his own home the water supply was derived from cisterns, and in Galveston, since his first entrance into the medical school, from cisterns and deep artesian wells. Early in his life, from his ninth to his twelfth year, he had suffered from an obstinate diarrhoa. but had quite recovered from this, and for some years his health had been perfect. Since the Haskell County trip, however, he had noted continuously more or less abdominal disturbance: diarrhea alternating with constipation, with occasionally small amounts of blood distinguishable in the feces, and usually more or less abdominal discomfort if not actual pain. In this case there is the history of the habit of chewing raw cotton in the gin when the patient was engaged at work in the gin, but nothing more nearly approaching the "dirt-eating" habit; there is no history of "ground-itch." During the summer and fall of 1900 (the year preceding the discovery of the parasites) the man was somewhat pale and weak, and because of the indefinite abdominal disturbance suspected the presence of intestinal parasites of some sort. During the same time there were occasional irregular paroxysms as from malaria, promptly ceasing upon the administration of quinine, but invariably reappearing if the drug was left off. This continued until in February of 1901, when the hæmatozoa were sought for and found without difficulty, and a persistent and thorough dosage with quinine was instituted, since when there have been no further disturbances of During this period, too, the patient noted the development of a shortness of breath and slight swelling about the ankles without any important change in the urine. On May 7, 1901, in the routine examination of samples furnished by the class a number of hookworm eggs were found in the patient's feces; and on May 26th, after the administration of thymol, as in the preceding case, twenty-four examples of the uncinaria americana were obtained. Subsequent examination of the stools failed to show the presence of more ova; and to date of writing the patient, now a fourth-year medical student, has recovered entirely from all his symptoms, has increased markedly in weight, his color fully returned, all signs of circulatory and alimentary fault having entirely disappeared. A blood examination made at the time of examination, or shortly after, showed a decrease of the red cells to 4,100,000; white cells, 8000; hæmoglobin, 90 per cent. Unfortunately, the slide preserved for differential leucocyte count was mislaid, but there was a distinct but not very great eosinophilia evident.

The habit of cotton-chewing referred to in this case is mentioned because it is, perhaps, allied to the habit of dirt-eating noted in an important proportion of hookworm cases. It would give but little opportunity for belief in it as a means of transmission of the embryonic worms, which would surely be killed by desiccation if long in the dry cotton. The habit here is probably no more than a secondary pica, as the pica of chlorosis; and probably in many dirt-eaters the habit should be looked on in much the same light, although, according to the prevailing views as to the life-history of the parasite, it is possible, of course, that at times the habit may be the basis for actual transmission of the embryos to the human alimentary canal.

Case IV.—T., male; junior pharmacy student; aged twenty-one years; residence in Bastrop County (179), where he has lived continuously since birth, save that during his school vacations he has travelled over the greater part of the State, but has never been beyond the State limits. At his home the source of drinking water has been from a well sixty feet in depth; water calcic. Has had no important acute sickness for years prior to the discovery of the parasites in question, but has been subject to griping abdominal pains as long as he can recall (could never eat fruit, especially apples, in the evening without bringing on an attack of this sort, but would always find prompt relief from a little spirits of camphor). No chills for at least ten years; no diarrhea. Three years before the discovery of the parasites he lost nineteen pounds in weight from some unknown cause within a period of two months, but regained the loss during the following winter. Eight or ten years prior to the time of discovery of the parasites his legs and ankles were frequently extremely painful, and often swelled; but these symptoms have not been noticed at all in recent years. Intestinal discharges were habitually firm; never noticed blood admixture. No dirt-eating habits; but the gentleman recognized the possibility of contamination of food from his dirty hands in the course of his farm work at home. There is no history of "ground-itch."

On May 8, 1901, numerous eggs of the hookworm were found, along with vast numbers of trichomonads, in the discharges of this individual in the course of the routine examination of samples submitted by the class; and on May 21, 1901, after the administration of ninety grains

of thymol, with the usual precautions, 202 samples of the uncinaria americana (Stiles) were obtained. It was from samples from this case that material was sent to Dr. Stiles, upon which he has based the recognition of the American species of hookworm, a type placed in the museum at Washington being from the same case; specimens from the same case being used in preparation of the drawings illustrating the present article. At time of examination the patient was a tall, spare, sallow young man, with a blotchy complexion, with a slow, weak type of movement, and with a habit of expression much as described by Stiles (sup. cit.) as characteristic of medium infections. There were no evidences of the existence of any important disease, and, because of press of other work in connection with the final school examinations, no blood examination was made. The patient left Galveston the day after the discharge of the parasites; in personal letters he has stated that for some weeks he felt unusually weak, and during the summer he passed through a prolonged febrile course mentioned in his letter as "slow fever." On October 24, 1901, a letter from the patient stated that he had never entirely regained his flesh and strength after this fever, but that his

color was slowly returning.

Case V.—McC., white; male; medical student; aged twenty-four During the past five years has lived for the most part in Texas, but, as a railroad operator and as a ranche hand, has been in the Indian Territory, Louisiana, New Mexico, Mexico, and Colorado, as well; and in his wanderings has frequently been forced to drink water from very questionable sources. For years he has been in exceptionally good health, except for an eruption of the nature of a giant urticaria, at one time diagnosed by a physician in New Orleans as angioneurotic For years he has had no malarial paroxysms (but, it should added, shortly after the discovery of the ova of the uncinaria in his stools he had a slight chill, for which, without attempting to find the hæmatozoa, he treated himself with quinine, and has had no recurrence). For two years prior to the discovery of the ova he has suffered from attacks of painful diarrhea, alternating with periods of obstinate constipation, with occasional small amounts of blood in the stools, which were usually light-colored and soft. No history of "ground-itch;" no dirt-eating habits (save the possibility of conveying dirt to his mouth from his hands when the latter were unclean from work). At time of examination of this case there were no symptoms of importance; very few ova were found at this time (May 8, 1901), along with many trichomonads and a few parameecia, and at the request of the writer the patient consented to refrain from attempting to get rid of the parasites, in order that some idea might be obtained from the case as to their natural persistence in the intestine. At irregular intervals the stools have been re-examined, the last successful examination having been in the autumn of 1902, the first failure during the Christmas holidays of 1902; at time of preparation of this article (May 3, 1903) a very careful search was again made, but without success, although during the entire interval, and at present, the infusoria noted in the first examination have been encountered. A differential leucocyte count in a specimen of blood obtained at the time of discovery of the ova indicates the following proportions of the white blood cells: eosinophiles, 5 per cent.; small lymphocytes, 23 per cent.; large lymphocytes, 4 per cent.; polynuclear neutrophiles, 68 per cent. No count of red and

white cells was made at the time of the original examination; recently a blood count was made in which a plethora of red cells existed, 5,680,000; white cells, 7600; hæmoglobin (Dare), 90 per cent. There have been no symptoms in the interval referable to the presence of the worms, and their disappearance has seemed to have had no effect on the urticarial eruption above mentioned, and none upon the abdominal

symptoms narrated.

Case VI.—On May 9, 1902, in a yellow, clay-like, and mushy stool from a senior pharmacy student, C., a small number of hookworm ova were encountered, together with a few amæbæ and numerous trichomonads. Mr. C., aged twenty-three years, is a resident of Houston County (141), and prior to the above date had never been beyond the limits of the State. Within the past five years he has, in addition to his life at home, lived six months in Huntsville (83), ten months in Runnels County (134), twenty-four months in Galveston, and four months in Lufkin (142), Texas. At his home the source of drinking water was from surface wells; the same in Runnels County; in Lufkin, underground cisterns and surface wells; in Huntsville, overground cisterns and artesian wells; in Galveston, the same. His habits and occupation as a drug clerk give no trace of any dirt method of infection. In general his health has been good for many years; has had no more than two or three chills during the five years prior to examination of stools, and these responded readily to quinine and were regarded as of malarial origin (but without blood examination to verify this belief). Has had no important losses in weight. During the winter preceding examination has noted periods of mental dulness, supposed to have been occasioned by mental fatigue from close study, and suffered slightly from an intermittent diarrhoa. At time of examination Mr. C. was apparently in good health; his complexion clear, with a slight pallor (no more, however, than is common to persons accustomed to an indoor life for years), and with a frequent play of color suggesting a vascular ataxia (the latter a symptom of long standing). No other symptoms of importance could be made out. Leucocyte count from smears taken at this time give the following: eosinophiles, 22 per cent.; small lymphocytes, 16 per cent.; large lymphocytes, 2 per cent.; polynnelear neutrophiles, 60 per cent. On June 11, 1901, after administration of ninety grains of thymol, with the usual precautions, followed by salts, four specimens of the uncinaria americana (Stiles) were obtained; and subsequent examination of the stools failed to show the presence of ova. Personal letters from Mr. C. inform the writer that since the above there have been no important features of any type developed in the case.

Case VII.—J., white; male; aged twenty-four years; medical student; residence in Harrison County (95), where he has lived for more than five years prior to the date of examination resulting in the discovery of the parasites in question, for the most part in the town of Marshall, not having been without the bounds of the county in the same length of time, save when in Galveston pursuing his medical studies. The water supply of Marshall is from artesian wells sunk some five miles away from the town; when in the country (Harrison County) the patient's water supply was obtained from springs and from surface wells; in Galveston the water was obtained from the city artesian supply. There was nothing in the history of the case suggesting any dirt habits in the acquirement of the hookworms, and no history

of ground-itch. In the summer of 1900 he had chills (no blood examination) which yielded for the time readily to the use of quinine. During the fall and winter of 1900 and 1901 the chills recurred, and on several occasions the tertian parasite was discovered. These chills continued irregularly up to the time of discovery of the ova in the stools, although during the same period he continued with more or less regularity the use of quinine. During the same period he suffered from an intermittent diarrhea (stools dark and sometimes almost liquid, without gross appearance of blood admixture), alternating with a few days of constipation from time to time. During this time and up to the date of discovery of the hookworm ova he lost fourteen pounds in weight and became somewhat anemic in appearance. On May 9, 1901, ova of the hookworm were found in large numbers in the stool in the routine examination of fæces from the various students; and on May 19th, after administration of thymol and salts in the usual manner, there were obtained 389 examples of the uncinaria americana (Stiles). examinations revealed no further presence of ova in the discharges. Subsequent to the removal of these parasites the patient had one chill, and was at once given quinine in full and persistent dosage, from which time to the present he has been entirely free from further attacks of this From this time onward the patient rapidly regained his former health and weight, and his usual ruddy complexion returned. In blood examinations made for the malarial disturbances prior to the examination of the stools it had been noted that there was present a moderate leucocytosis, but not any marked diminution of red cells, and the eosinophile cells were apparently increased (but no differential count of leucocytes was made). Through a misunderstanding, the patient, an advanced student who was to have made for the writer an estimate of the blood cells before taking the anthelmintic, did so after the worms had been discharged, in which examination a distinct and interesting plethora of red cells was recognized (6,100,000), probably due to the withdrawal of a distinct part of the watery element of the blood; at the same time the leucocytes were distinctly increased (20,000 to the cubic millimeter).

Case VIII.—G., white; medical student; aged nineteen years; a resident of Austin County (244); has never been outside the State limits; has lived for two years in Galveston, as required in his medical work, and for a short time, during vacations, in Lavaca County (207). In both of the latter places the source of drinking water was from artesian wells (in Galveston also from overground cisterns), and at his home from sur-There was nothing in the patient's history bearing on the acquirement of the parasites through dirt habits, unless through the eating of raw garden vegetables, which might, possibly, at times not have been sufficiently well washed; the patient recalls that several years prior to the discovery of the ova in the stools he had had a severe" ground-itch" about the hands and wrist, supposed to have been acquired from the garden ground in which he was then employed for a large part of his time. In 1900, while living in Austin County, the patient had for about five months suffered from a severe indigestion, but had had no diarrhea or pain of importance in connection About this time, too, he had had a number of malawith the attack. rial paroxysms, which always were checked by the use of quinine, until after he came in the fall of the same year to Galveston to college.

the latter city a blood examination revealed the presence of the tertian parasite, and in spite of persistent treatment with large doses of quinine the affection grew worse. At the time of examination (May 21, 1901) the man was slightly anæmic, his complexion blotchy, and he exhibited an unusual degree of tremulousness of the hands and face; there were no appreciable respiratory symptoms; no vascular or circulatory disturbances; he complained of easy physical fatigue and mental tire; slight, dull, uncomfortable feeling, general throughout the abdomen; no important digestive failure; no urinary symptoms. May 21, 1901, a number of uncinaria ova were found in his stool, and on May 24th ninety grains of thymol were administered, resulting in the recovery from the stools of sixteen examples of the *uncinaria* americana. Subsequent examination of the stools failed to reveal further presence of ova. Differential leucocyte count in smears, taken just before the administration of the thymol, showed the presence of an eosinophilia of 12 per cent.; small lymphocytes, 20 per cent.; large lymphocytes, 6 per cent.; and polynuclear neutrophiles, 62 per cent. After taking the thymol and continuing the use of the quinine as before, there occurred two further chills, after which the entire symptom group referable to malaria completely disappeared; and to the present the patient has been steadily improving, having lost all symptoms save his tremulousness, which is no longer comparable, however, to its former degree.

Uncinables in the United States. At the time of the discovery of the parasites in the above-mentioned cases it was not suspected that there existed in man any other species of the hookworm than that first described by Dubini¹ in 1843, under the name anchylostoma duodenale,² and the few cases published from the United States had been invariably spoken of as if identical with this old-world species—a belief which, in the light of our present knowledge, is a matter of more or less doubt for the individual cases. So, too, although a foreign importation was at least suggested in such cases, it is equally a matter of doubt whether the parasites were not really obtained in the localities where found. Certain writers speak of its recognition (referring to uncinaria duoden-

Annal, univers. di med., April, 1843, vol. cvi. pp. 5-13.

² In this paper the writer has employed the term uncinaria duodenalis (Dubini) Raillict, 1885, as the proper generic and specific name of the old-world bookworm, more commonly spoken of as anchylostoma duodenale, Dubini, 1843. The generic title anchylostoma was preceded by that of uncinaria (Froelich, 1789) for those meromyarial strongyloid worms whose anterior extremity is curved dorsally into a booklike shape. The division into the proposed genera uncinaria and anchylostoma, resting mainly on the absence or presence of distinct hooks upon the rim of the buccal capsule, seems scarcely justifiable; the gradation is clear from uncinaria canina, with its bilateral yeutral trios of such "teeth, to uncinaria duodenalis, with its bilateral pairs of similar structures in the same position, to uncinaria stenocephala, with its bilateral single large tooth springing from the lower surface of a prominent ventral lip, to uncinaria americana, with its bilateral large ventral chitinous untoothed lip, indicating that such a lip in the last-named worm is but a simplified represcutative of the more complex buccal armature of the previously mentioned examples, possibly the primitive type of such armature. For this reason, until other data justifying the division of the original genus be brought forward, the writer would prefer to retain all the group possessing buccal armature consisting either of prominent lips or hooklike teeth under the generic classification here adopted.

alis) in America at an earlier date than the publication of Dubini,1 but it is doubtful whether any of the earlier American writers, while probably discussing cases of uncinariasis, had any idea of the real nature of the affection. In this category are to be placed the writers named in the above references, Chabert (1830) and Duncan (1840) in Louisiana, Lyell (1849) in Alabama and Georgia, Heusinger and Geddings in South Carolina, and Little and Letherman in Florida. As far as the writer's knowledge extends, the case of Herff (sup. cit.), in 1864, in San Antonio, Texas, which was possibly of Mexican origin, was the first recognized in the United States; and in this case the recognition was uncertain, but probably correct for one or other species of the hookworm. (The specimens shown by White' before the Boston Society for Medical Improvement as examples of uncinaria duodenalis were Brazilian in origin, having been obtained from a patient of Dr. Wucherer, of Bahia, and their specific classification is at this time uncertain.) Blickhahn's case,3 reported as uncinaria duodenalis in 1893, from St. Louis, Mo., was the first positively recognized in this country; it occurred in the person of a brickmaker, seventeen months in the United States from Germany, and was supposed by Blickhahn to have been imported from the latter country. Probably the actual recognition of the endemic existence of the hookworm in this country rests in the discovery of the ova in 1895, as above mentioned, by the writer; but the failure in that instance to discover the host made it undesirable to give any publicity at this time of the fact, and, of course, no strict priority can be claimed because of the failure of publication. Moehlau,4 in 1897, reported five cases (more recently the subject of some doubt) as examples of uncinaria duodenalis; and the infection here was supposed to have been imported or to have followed imported cases. Gray, in 1898, encountered a case determined as uncinaria duodenalis and known to have developed in Virginia; and in 1899 Tebault⁶ described a case which was probably due to the American species, undoubtedly arising in New Orleans. Cases of Porto Rican origin were reported from New York by Ashford,7 from Baltimore by Hemmeter,8 and by Boston,9 of Philadelphia, as having been recognized in 1900. All of these cases, were probably of the American type of the hookworm. Early in 1901

¹ Dolley. Annual of Univers. Med. Sci., 1891. Blanchard, Traité de Zoologie Méd., vol. i., p. 769.

² Boston Medical and Surgical Journal, vol. lxxv. p. 427.

³ Medical News, vol. Ixiii. p. 662.

⁴ Buffalo Medical Journal, March, 1897.

⁵ Virginia Medical Semimonthly, September 27, 1901.

⁶ New Orlcans Medical and Surgical Journal, September, 1899.

⁷ New York Medical Journal, April 14, 1900.

Stiles. Eighteenth Annual Report Bureau of Animal Industry, U.S. Dept. of Agriculture, p. 210.

⁹ Allyn and Behrend. American Medicine, July 13, 1901.

Dyer' reported a case of certain domestic origin, probably of the American type of parasite. In the same year a case was recognized in Albany, N. Y., as uncinaria duodenalis of Philippine origin, by Ward,2 and a second, probably of Italian origin, by Neuman.3 The case reported by Dr. M. C. Schaefer from Galveston, in April, 1901, before the Texas State Medical Association, was undoubtedly of Mexican origin. It was reported under the name anchylostoma duodenale (uncinaria duodenalis), but the writer has, since the establishment by Stiles of the species uncinaria americana, definitely identified it with the latter. It was discovered in February, 1901. In the paper of this author the writer's first two cases were mentioned, both later identified as uncinaria americana, both having been found in March of the same year. In May of 1901 the remaining six of the above series described in this paper were encountered, these, also of the American species; and later in the year two more cases of the same type, not yet published, were found in the wards of Galveston hospitals by Dr. J. T. Shortly after the cases of the writer's series, Claytor met with a case of uncinaria americana originating in Virginia,5 and quickly following appeared the discovery of a case of uncinaria duodenalis of Italian origin in Philadelphia, by Allyn and Behrend. Later in the year the case of Hall7 and Yates8 was published, having been encountered in the person of a sailor usually travelling between England and the United States, but who had recently been in Vera Cruz, Mexico; this proving to be a case of the old-world hookworm. Still later in 1901 Bailhache⁹ described a case from New York, of uncertain species and of uncertain origin (South America?).

Subsequent to these reports of hookworm in this country, publications of similar discoveries in a wide range in the United States have appeared, principally in the Carolinas, Georgia, Florida, Alabama, and Texas, but also from Illinois and California—although the reports from the latter States would indicate the infection to have taken place in Panama, the Philippines, Mexico, and Porto Rico, and at least one case to have been an instance of uncinaria duodenalis. Of these pub-

¹ Interstate Medical Journal, March 15, 1901.

² Albany Medical Annals, January, 1903.

³ Stiles. Eighteenth Annual Report Bureau of Animal Industry, U. S. Dept. of Agriculture, p. 215.

⁴ Trans. Texas State Medical Association, 1901; note in Texas Medical News, May, 1901; Medical News, October 26, 1901.

⁵ Philadelphia Medical Journal, June 29, 1901; THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, January, 1902.

⁶ American Medicine, July 13, 1901.

⁷ Journal of the American Medical Association, November 30, 1901.

⁸ Johns Hopkins Hospital Bulletin, December, 1901.

⁹ Stiles. Eighteenth Annual Report Bureau of Animal Industry, U.S. Dept. of Agriculture, 9. 215.

¹⁰ Stiles. Bull. No. 10, Hygienic Laboratory, U. S. Public Health and Marine Hospital Service, February, 1903; Herrick, American Medicine, July 19, 1902; Harris, ibid., July 19, and November

lications none approach in importance the bulletin of Stiles, who, as zoölogist of the United States Public Health and Marine Hospital Service, has added much the greater part of our knowledge of the distribution and influences of the American type of hookworm. To Stiles, too, is due entirely the credit of establishment of the species uncinaria americana and its exact differentiation from the previously known uncinaria duodenalis, using as material specimens from Porto Rico and Ashford's cases, from Claytor's Virginia cases, and from Case IV. of the writer's series from Texas.¹ The same author, basing his opinions upon theoretical grounds, obtained in his studies in comparative parasitology and a few cases reported from this country, had in 1901² called attention to the probably wide prevalence of hookworm disease in man in the southern parts of the country, a position amply proved by his own brilliant discoveries and the added testimony of others during the past year.

From personal study of examples of the parasites obtained from the cases detailed above, the writer was aware of a distinct difference between these worms and uncinaria duodenalis, and from some similarities to uncinaria stenocephala of the dog was at first inclined to believe the parasites of Dr. Schaefer's case and of Cases I. and II. of the above series found in the Texas medical students to be a variety of the latter, and that perhaps dogs bore some part in the disease and its prevalence among men. After the publication of Stiles, announcing the species uncinaria americana,3 no difficulty in establishing the identity with the latter of the parasites in all the Texas cases was experienced. Thus far, in these and other cases coming to his knowledge in this State no examples of uncinaria duodenalis have been recognized. So, too, the majority of specimens met in the southern United States generally, in Porto Rico and elsewhere in the West Indian Islands, and at least some of those originating in Mexico and elsewhere in Spanish America are known to belong to the same species; which, hence, must have a wide American tropical and subtropical range of distribution, and which there is reason to believe has been carried thence into other parts, as into the Philippines, and, possibly, into the Spanish peninsula in Europe by travel.⁵ In these Spanish and Portuguese-American districts

^{15, 1902;} Smith, ibid., June 21, 1902; Capps, Medical News, November 29, 1902, Jonrnal of American Medical Association, January 3, 1903; and Brown, Occidental Medical Times, March, 1993.

¹ Type specimen No. 3310, Bureau of Animal Industry, U. S. Dept. of Agriculture.

² Texas Medical News, July, 1901.

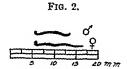
³ American Medicine, May 10, 1902.

⁴ Since writing this paper the author has encountered, in July, 1903, a case of pernicious anæmia dead from the old-world hookworm, which he proposes to use in a further paper as a basis of comparison with uncinaria americana.

⁶ As a matter of scientific interest it should be inquired into whether possibly the reverse of the above idea may not be true, *i. e.*, whether *uncinaria americana* may not be an East Indian parasite which was perhaps carried into tropical America with the ancient inhabitants, who

there are also to be met instances of the old-world hookworm, probably brought in a similar manner from Europe to this continent. From our present knowledge of the influences of the parasite, it seems certain that many of the early references by American writers to endemic anæmias associated more or less with the dirt-eating habit are to be correlated with uncinariasis, and it, therefore, is not unreasonable to think that, probably, the worm was endemic among the aborigines of the above-mentioned areas of America, and was transmitted by them to the whites, and thus to the present occupants, generation by generation.

Description of Uncinaria Americana (Stiles). Superficially, uncinaria americana (Stiles) bears close resemblance to uncinaria duodenalis, differing mainly in the nature of the buccal armature; it is somewhat smaller, as a rule, but individual instances attain the lower measurements named for the old-world parasite; there are also slight but important differences in the sexual bursa and its rays in the male worms, and the ova of uncinaria americana are larger than those of uncinaria duodenalis, and are apt to be found in more advanced embryogenesis



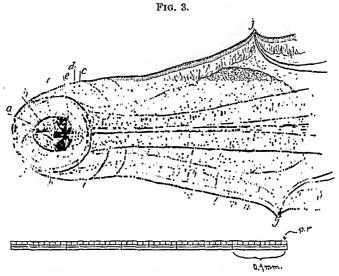
Showing actual size of male and female uncinariæ.

These worms are nematodes of the family strongylidæ, subfamily strongylinæ, genus uncinaria. They are elongate, cylindric, tapering in both sexes toward a blunt head end, and having the anterior extremity curved dorsally, this giving the characteristic "hook" type of the genus uncinaria. The posterior extremity of the female is mucronate; the male ending suddenly in a blunt tip, without gradual contraction, within the caudal bursa. The color is whitsh or cream-colored, sometimes the contents of the alimentary canal giving the worm a slightly brownish tint in the middle half. In their thickest part they average 0.4 mm. in thickness, ranging from 0.3 to 0.6 mm.; the males are usually 7 to 8 mm. in length, ranging from 6 to 9 mm.; the females usually 10 to 11 mm. in length, ranging from 8 to as much as 14, or even 15 mm. occasionally (Fig. 2). The measurements given by Railliet¹ for the male uncinaria duodenalis are 8 to 11 mm. in length, females. 10 to 18 mm.

are more or less generally regarded as the progenitors of the South and Central American and Mexican races of American aborigines. Could a marked predominance of this species be established as existing in Eastern Asia and the Pacific archipelagos, particularly in the relatively uncivilized Pacific islands, it would not only be of importance from a point of medical geography but also would prove a valuable item in ethnography.

¹ Traité de Zool. Méd. et Agrie., Paris, 1895, p. 465.

The mouth opening is directed dorsally, and is to be seen only in specimens arranged to exhibit the dorsal side of the head (Fig. 3). It is formed by the delicate, transparent cuticle, which here becomes continuous with the lining of the buccal cavity. It is of an elliptical shape, its long axis directed anteroposteriorly, measuring 50μ to 70μ in long axis, and 40μ to 50μ transversely (but varying considerably in different specimens, and, undoubtedly, in life capable of considerable contraction and expansion). The walls of the buccal cavity are supported throughout the greater portion by a chitinous capsule of a cup shape. This is composed of at least four pieces, two large curved lateral plates incompletely separated along the dorsomedian and ventromedian lines, a thin, curved quadrilateral plate placed internal to

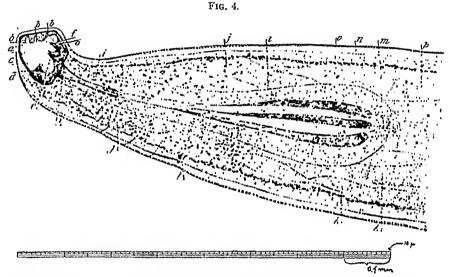


Dorsal view of cephalic end of uncinaria americana. a. Oral cuticular margin. b. Large chitinous ventral lip. c. Smaller chitinous dorsal lip. d. Dorsal conical tooth. c. Lateral lancets. f. Ventral lancets. g, h, i. Oral papillæ. j. Cervical papillæ, with duetus of cervical glands. k. Muscular wall of cesophagus. l. Esophageal glands. m. Muscular layer of body wall. n. Cuticle.

the dorsal line of separation of the lateral plates (dorsal extension of dorsal conical tooth), and a thickened marginal ring serving as a rim to the cup, also incompletely divided dorsally and ventrally. The latter bears on each side of the capsule two lips, the larger ventral lip (the analogue of the ventral hooklets of uncinaria duodenalis) projecting into the buccal space beyond the margin of the true mouth, the smaller dorsal lip extending close or quite to the margin of the latter. Beneath (toward the base of the capsule) these lips on each side of the capsule may be seen three papillæ projecting into the cavity, the ventral and lateral directly beneath the large ventral chitinous lip, the smaller beneath the smaller dorsal lip about its middle. These papillæ are covered by the oral membrane which rises in longitudinal folds

from below upward to the apices of the papillæ, giving rise to faint lines from the pharyngeal armature toward the rim of the buccal capsule. In some specimens the papillæ appear spiculated at the tip.

The shape of the buccal capsule may be apprehended from the accompanying drawings of the dorsal and lateral views of the head (Figs. 3 and 4). Viewed from the dorsum it is seen to have at the rim an almost circular outline, and deeper in the cavity to be slightly elliptical, the transverse diameter being slightly larger than the dorsoventral. Viewed laterally the rim of the capsule is nearly straight, in general parallel with the long axis of the worm, while the ventral line is the longest and most curved boundary, the line of the base being nearly



Lateral view of eephalic end of uncinaria americana. a. Buccal cavity. b. Oral papilla. c. Chitinous capsule. d. Ventral lancets. c. Lateral lancets. f. Dorsal conical tooth, with (g) its posterior extension reinforcing part of capsule. h. Interior of exophagus; its chitinous wall continuous with the pharyngeal teeth above. i. Muscular wall of exophagus. j. Gesophageal glands opening into the pharynx. k. Cervical glands opening externally at cervical papilla. l. m. Trilobed valvular opening of exophagus into intestine. p. Intestine. n. Muscular layer of body wall. o. Cuticle.

straight and directed in nearly a right angle to the line of the rim. A short, straight dorsal limit connects the rim with the dorsal end of the base line. There is some variation in the measurements in different specimens; but, as a rule, the distance from the extreme depth of the buccal capsule to its rim is 100μ ; the dorsoventral diameter (outer lines) at the widest part is about the same, the transverse diameter being equal to the latter at the upper part and slightly greater in the broadest portion, deeper within the cavity.

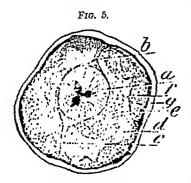
Through the base of the capsule rises the chitinous lining of the pharyngeal portion of the esophagus with the peculiar pharyngeal armature of the worm. This consists of certain chitinous tooth-like

structures joined more or less in continuity by reflections of the lining membrane of the cavity, so as to form a funnel-like opening supported by the chitinous projections. There are five principal chitinous elements, with several small intermediate ones, set into the chitinous wall of the pharynx. Of these the most striking and unvarying in position is the so-called "dorsal conical tooth," set in the dorsal wall and reinforcing by its dorsal plates the break in the dorsal wall of the buccal capsule (Figs. 3 and 4). It is composed of a chitinous plate rising well into the buccal capsule cavity, arched from side to side so that the dorsal surface is slightly convex, while at the median line a groove in the dorsal side causes a slight longitudinal fulness on the ventral surface, in some positions giving the impression that the tooth is longitudinally divided. The plate rises to a pointed tip, and, as it does so its sides fold dorsally and again rise back of the tooth as a reinforcement of the posterior wall of the capsule, and bear a fold of the oral membrane, which thus dorsally envelops the tooth. The other four chitinous elements are symmetrically arranged, two on either side of the median line. The laterals are to be seen on either side and close to the dorsal conical tooth, each rising as a thin conical projection with spiculated tip (thus in lateral views-from above downward or dorsoventrally, more widely conical), evidently moving transversely and slightly dorsoventrally in projection and retraction of the œsophagus. These receive the fold of membrane from the dorsal plates of the dorsal conical tooth, and are connected by similar and deeply curving folds with the ventral teeth. They are apparently also connected with each other by a similar fold extending transversely and on the ventral side of the dorsal conical tooth, this fold forming the dorsal boundary of the pharyngeal funnel. The ventral teeth, known as the ventral lancets, are broadly conical when viewed laterally, narrower when seen from above downward or ventrodorsally. When everted they lie close to the curved ventral boundary of the buccal capsule, one on either side of the median line, a deep groove separating them, save where a loose low fold of the oral membrane extends between them to form the ventral border of the pharyngeal funnel. Laterally, a fold passes from each to join the neighboring lateral tooth, forming the low lateral margin for the funnel of the pharynx. These ventral lancets are moved in action toward the dorsal conical tooth and from above downward, with possibly a slight lateral play. They are spiculated at the tip.

In effect this arrangement is admirably adapted to the suctorial habits of the worm. When the esophagus is forced forward into the base of the capsule the pharyngeal membrane and its attached chitinous teeth are everted to form a rather wide funnel, into which is drawn a tiny part of the intestinal mucous membrane of the infected individual

when the worm is feeding; the esophagus is then retracted, bringing the tips of the ventral laucets dorsally and downward and the tips of the lateral teeth toward the median line on the ventral side of the dorsal conical tooth (Fig. 3). The latter in this movement is drawn slightly ventrally, but is apparently less motile than the other elements. Close about the bit of tissue thus grasped the membranous pharyngeal border is drawn, insuring efficiency of suction from the tiny wounds inflicted by the action of the chitinous teeth. Doubtless in grasping the mucous membrane of the bost the whole capsule with its chitinous lips and papille plays an important part, movements of retraction of the esophagus at the base of the buccal capsule tending to spread the transverse diameter of the buccal rim, and protrusion of the esophagus into the base widening the latter and narrowing the rim; the alternate capsular and pharyngeal action suggesting a high degree of service in the work required.

From the above description it may be readily apprehended that much confusion is to be expected in the study of this apparatus, either in sections or in the undivided head; the relative position of the teeth and pharyngeal membrane varying so as to present quite different appearances of detail in different specimens, even in practically the same



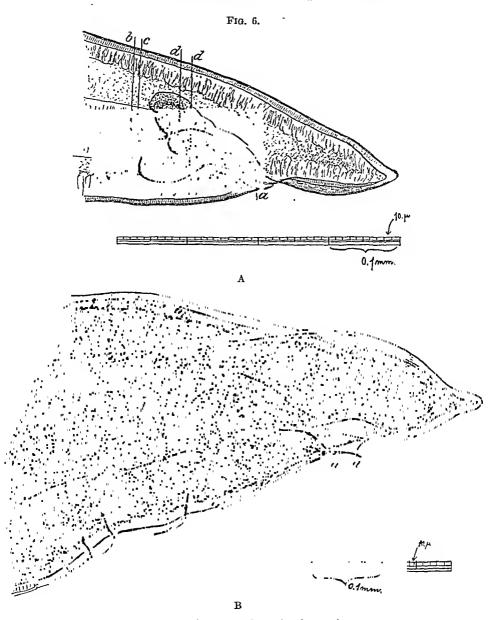
Transverse section of upper cosophageal valvular expansion, showing triradiate appearance of interior. a. Geophagus. b. c. Dorsal and ventral muscular attachment of cesophagus. d. Body space. c. Geophageal glands. f. Muscular wall. g. Cuticle.

plaue of section or in the same direction of examination. Probably the easiest mode of study is obtained by dividing the neck as close as possible to the head, so as to relax the esophageal structures, when the pharyngeal funnel and its chitinous elements are likely to assume a fairly separated and distinct position for observation. By careful manipulation such a head may be studied in water, with and without a cover, in its different aspects without much difficulty.

Two glands, the esophageal glands (Fig. 4), open into the base of the capsule, apparently just within the line of the ventral lancets. These may be presumed

to furnish a salivary fluid destined to aid in preserving the fluidity of the blood as it is being drawn from the wounds inflicted by the chitinous teeth, and may possibly have some toxic influence upon the individual infected, and thus be an element in the production of the clinical features of uncinariasis.

Viewing the head from the dorsal aspect the esophageal opening is seen beneath (ventrad) the dorsal conical tooth as a crescentic opening (convexity directed ventrally), into which the lateral teeth extend from the sides toward the median line; and from the ventral border the ventral lancets extend dorsally across it. It should be remembered, however, that a groove corresponding to the space between the ventral



Posterior extremity of female uncinaria americana.

A. Lateral view: a. Anal papillæ. b. Interior of intestine. c. Wall of intestine. d. Anal glands.

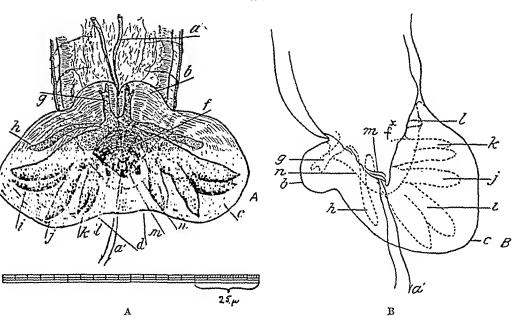
B. Same subject from a somewhat larger specimen and viewed ventrolaterally, showing anal opening expanded: a. Anal papillæ, showing small ehitinous tips.

lancets, but hidden by the pharyngeal membrane between these structures, exists, and that, therefore, the opening is really triradiate, an appearance carried into the upper part of the esophagus (Figs. 4 and 5).

The esophagus (Fig. 4) is a thick-walled muscular structure, in its upper portion lined internally by chitinous material. It is of an elongate flask-shape, circular in transverse section, its upper end terminating abruptly at the base of the buccal capsule, to which its outer portion is attached and through which the inner part slightly projects into the lower part of the buccal cavity. It is thicker posteriorly than anteriorly, measuring at its thickest part about 150μ to 160μ , and is about 700μ to 750μ in length. At its posterior extremity it opens by a valvular arrangement into the straight, wide intestine.

The intestine opens in the female by an anus guarded by small anal valves close to the tip of the tail on the ventral surface (Fig. 6). In

Fig. 7.



Posterior extremity of male uncinaria americana.

A. Dorsal view, bursa spread open and dorsal lobe thrown upward over body of worm: a. Inner end of genital spicules. a'. External barbed extremity of spicules. b. Subdivided dorsal lobe of bursa. c. Large lateral lobe of bursa. d. Limits of inconspicuous ventral lobe of bursa. f. Dorsal aspect of tip of tail within bursa. g. Bipartite-tipped dorsal ray. h. Dorsalateral ray. i. Divided lateral ray. j. Ventro-lateral ray. k. Divided ventral ray. l. Inconspicuous subventral ray. m. Opening of cloaca, with chitinous furcula, n. Cutiele of tail.

B. Lateral outline view of same; letters as above.

the male it terminates in common with the sexual organs in the blunt tip of the tail lying within the caudal bursa, the opening being on the dorsal side close to the tip (Fig. 7). Externally the worm is covered by a delicate, transparent, and finely transversely striated cuticle

¹ In a subsequent paper the writer wishes to describe more fully and exactly the details of the oral parts and the general structure of the worm, and for this reason prefers in the present discussion to pass briefly the features which are non-distinctive of this special parasite.

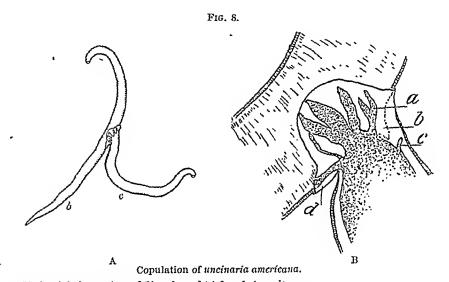
showing lateral, dorsal, and ventral longitudinal lines, the first being the more distinct. Beneath the cuticle is a layer of muscle, meromyarial, with internal extensions for the support of the intestine, sexual organs, and other structures. On the external surface, about $300 \, \mu$ back of the base of the buccal capsule on each side of the worm, there is to be seen a rather prominent papilla, at the summit of which opens a duct of a large gland, the cervical gland (Figs. 3 and 4).

The sexual apparatus, particularly the sexual caudal bursa of the male, is of importance in the identification of the species. The female genital opening is apparent on the ventral surface at a point just within the anterior half of the specimen, guarded by two transverse lips forming the sexual valve. From this a short vaginal canal extends internally and divides into the anteriorly and posteriorly directed uterine canals, which lie in a tortuously plicated manner along the intestinal tube. From the extremity of each a narrow tubal continuation forms the ovary, each of the latter ending blindly in the upper part of the worm, the posterior ovarian tube having turned upon itself to attain this anterior termination. Within the uterine canals of the pregnant females are to be seen great numbers of ova in various stages of development and segmentation, in occasional instances the embryo being visible within the shell.

The male sexual apparatus consists of a pair of testicles, long narrow tubes analogous in appearance and disposition to the ovarian tubes of the female, which unite suddenly about the middle of the specimen in a large sac, the seminal vesicle, which in turn opens into a rather large, straight tube (the ejaculatory duct). This continues to the tail of the worm, where it opens in a papilla upon the dorsal side of the tip of the tail (Fig. 7). From this opening, whose sides are supported by a chitinous furcula the cornua of which are connected by a transverse lip, emerge two delicate filaments apparently of cuticular structure, retractile, barbed at the free end, and measuring 0.9 mm. in length (sexual spicules). Surrounding the caudal tip is the sexual bursa, an umbrellalike expansion formed of the folded cuticle, between the folds of which the muscular layer of the body wall sends out a number of finger-like extensions or rays which serve to expand the bursa or bring its lobes in apposition. In the expanded state (Fig. 7, A) this bursa presents a distinctly trilobed outline made up of two large lateral lobes and a partly divided smaller dorsal lobe; while the ventral outline shows a slight curvature forming an indistinctly marked ventral lobe. about the tip of the tail in the middle of this bursa the rays emerge

¹ Stiles working over material from Case IV. of the above series observed an instance of this almost viviparous possibility; in material from two other eases the writer has encountered similar appearances. The stools in each of these instances were quite fresh, and numbers of the worms exhibited active movements when obtained, and were at once placed in a formal-dehyde solution for preservation.

symmetrically from the body wall; a common base dorsally gives origin on each side of the median line to a small dorsal ray with bipartite tip and a long, slender, slightly clubbed dorsolateral ray (the latter bending into the dorsal portion of the lateral lobe of the bursa; laterally from a common base on each side spring a large, thick, divided lateral ray, a smaller simple ventrolateral ray and a divided ventral ray; near the ventromedian line on each side one may distinguish also a short, single, inconspicuous subventral ray. The ends of these rays are provided with tiny chitin-like tips. Transversely the bursa measures 95μ to 100μ , the dorsoventral measurement being from two-thirds to three-fourths as great according to the degree of expansion obtained in the specimen observed.



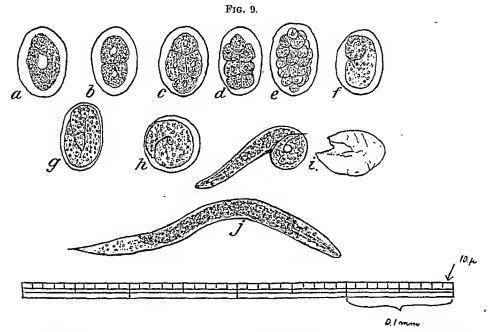
A. Moderately large view of (b) male and (c) female in coitu.

B. Detail of bursal application of male to body of female, higher enlargement: a. Ventral ray of male. b. Anterior lip of vagina. c. Subventral ray of male. d. Dorsal ray of male.

In coitus the male applies this bursa with its muscular rays about the ventral and lateral aspects of the female, so as to bring the sexual papilla in close apposition and slightly penetrating the female opening, the sexual spicules extending into the vaginal and uterinc canals. The coitus is prolonged; and occasionally specimens are expelled in congress after administration of the anthelmintic to the host, the bodies of the male and female, together, forming a Y-shaped combination as shown in the accompanying drawing made from a pair thus obtained from T., Case IV. of the above series (Fig. 8).

The ova, formed within the uterine canals of the female worm, are passed through the genital pore in large numbers, and constitute an easily recognizable microscopic element of the feces of the host. No special technique is required for their discovery beyond the application

of a small bit of the suspected stool upon a glass slide with a drop of water, if needed, to make the specimen nearly fluid, the adjustment of a cover-slip, and the use of a magnifying power of from 100 to 400 or 500 diameters, as may suit the wishes of the observer. In cases of even but moderate degree one rarely fails to find in the first bit of feces thus examined several of the ova; and in mild cases anyone familiar with the appearances should, with the low power of the microscope, be able to find within ten or fifteen minutes at least, one or more of the eggs in four or five trials. The ova have an elliptical outline (Fig. 9), are colorless, with a thin, transparent covering, and a granular interior in varying degrees of segmentation, or with a small

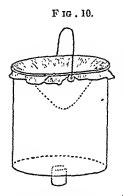


Ova and embryos of uncinaria amcricana. a. Unicellular ovum. b, c, d, e. Ova showing various stages of segmentation. f, g. Ova containing larval uneinariæ. h. Peculiarly shaped ovum. i. Larval worm just emerged from shell. j. Larva extended after emergence.

rhabditiform embryo enclosed. They measure in long axis 68μ , transverse 38μ to 40μ , with slight variations above or below these measurements in different specimens, the measurements of the ova of the uncinaria duodenalis given by Railliet being $52\mu \times 32\mu$.

In the recovery of the parasites from an individual in whose intestinal discharges the ova have been found, little difficulty has been experienced by the writer from the use of thymol. Filix mas has been lauded by a number of writers for the dislodgement of the uncinaria duodenalis; and in the first case of uncinaria americana falling under the writer's observation (the case of S., recorded by Dr. M. C. Schaefer, sup. cit.) this was in the beginning employed, but without success. A later use of

thymol in the same case was successful in removing one hundred and two specimens of the parasite; but in spite of several repetitions, occasional ova were detected in the stools thereafter. In the series of cases mentioned in the present article thymol was administered in six cases, in all being followed by the discharge of a greater or smaller number of the worms; and in none of these cases were ova discoverable in the stools subsequent to the single administration of the drug. In practice the writer has followed the method of administration commonly employed on the Eastern continent for the old-world hookworm. The patient, either with or without previous light purgation, is given a liquid supper the day before administration of the drug, and in the morning following is denied food until the bowels begin to act freely. At about seven o'clock in the morning, thirty grains of thymol in several capsules are administered, followed at intervals of an hour by two similar doses. An hour later (about ten o'clock) a dose of magnesium sulphate is



Filtration bucket used in washing fecal matter.

given if the loose stools have not already started. Until free action is had the patient is particularly cautioned against the use of any alcoholic or oil, lest such substances ingested should dissolve the thymol freely and lead to toxic symptoms. In none of the cases observed by the writer was such an accident observed. The stools caused by the thymol and the saline (in several of the above cases the salts were not used, the thymol alone being followed by free evacuation before the time set for the administration of the saline) are thin, watery, generally of a dark-brown color, have the odor of thymol upon them, and show the undissolved drug in larger or smaller particles. The stools are

most conveniently washed through a piece of cheese-cloth under a moderately forcible thin jet of water from the tap. A filtration bucket (Fig. 10), with the cheese-cloth fastened about the rim, so as to form a shallow funnel within, has answered the purpose well. When there is much mucus in the stool, preventing free filtration, the previous addition of an alkaline hydrate solution so as to dissolve the mucus has much hastened the operation. The washing is most rapidly done by putting but small portions of feces in the funnel at one time; and the jet of water should be played about the margins of the fecal matter to most rapidly carry the material through the cloth. The solid remnants after washing are transferred to a shallow dish filled with water, in which the parasites sink to the bottom, when they may be readily distinguished and removed to a separate container.

LIFE-HISTORY. The life-history of the particular species of hookworm under consideration has not been determined, but there seems

no reason to believe it materially different from that of the allied old-The latter is known after emergence from the egg as world species. a rhabditiform embryo, to undergo in its free state at least two moults, experimental observations after alimentary infection of dogs indicating that it subsequently undergoes a third and fourth ecdysis within the host; after which it is fully formed, but requires further growth to attain its adult size. From four to six and from some experiments as much as ten weeks seem requisite for its full development from the time of infection. The ova of uncinaria americana under suitable conditions (involving a fair access of oxygen, moisture, and a temperature of about 30° C.) give origin within twenty-four hours similarly to a rhabditiform embryo, measuring 220_{μ} to 250_{μ} (Fig. 9). Stiles (sup. cit.) has recognized these after the first and second moult in the free state, after two to three days for the first, and after seven to nine days for the second; and the same author insists upon the need for free access of air to the ova for rapid incubation, indicating that a moist, loose, sandy soil affords the most favorable situation in nature, and that hatching is prevented by actual submersion in water. The writer has made no attempts to follow the development of the parasites, but has found the embryos in numbers in thin fecal material exposed to the air for less than twenty-four hours at ordinary room temperature, suggesting that other conditions than mere submersion may have led to the latter conclusion of Stiles. In an attempt to grow the larvæ in a solid fecal mass at body temperature in a small incubator the eggs failed to incubate, and did not develop in the same substance after removal from the incubator to the general atmosphere of the room within five or six At the time it was not thought that the faulty factor was lack of moisture, the failure being attributed at the time to the temperature; but it seems not unreasonable to think that perhaps the real trouble was occasioned by drying (the stool was not, however, at any time dry beyond a putty-like consistence).

After emergence from the egg the embryo lives well in water; and either in unclean drinking water or in infested moist dirt adherent to various articles carried to the mouth, is probably, in a large number of instances, transferred from its free life to the alimentary canal of the host. The habit of "dirt-eating" or "clay-eating" has long been regarded as a probable mode of convection of the larve of uncinaria duodenalis from their free life in dirty water or in mud to the human host, an idea Stiles has correlated with the American hookworm and the "dirt-eater's anæmia" or "mountain anæmia" frequently met in the "poor white" class of our Southern States. In a large proportion of these dirt-eaters, doubtless, uncinariasis does exist, and, probably, sometimes the habit has occasioned the parasitism by the fact that the dirt eaten by the individual has contained embryo uncinariæ. It should not be lost to mind,

however, that dirt-eating is not necessarily mud-eating, and that much of the unclean matter chewed or actually eaten by these people cannot possibly have uncinarize in it. Frequently the habit is limited to the eating of some particular kind of dirt, as soot taken directly from the chimney, ashes from the hearth, ashes from a tobacco pipe, mortar taken from between bricks in a wall, dry ground, straw or chips; and the true "clay-eater" must be less likely than the real soil-eater or mud-eater to get the worms in his dry or semi-dry clay. Doubtless the habit is often secondary to the anemia occasioned by the parasite, just as the pica of chlorosis is a symptom rather than causative of the condition. Aside from the actual habit just discussed, it should be kept in mind that mud, possibly carrying the embryo parasites, may be carried to the mouth by the hands in case of individuals engaged in those occupations occasioning frequent soiling of the hands by such material (brickmakers, gardeners, ditchers, and others), or by improperly washed vegetables grown in moist ground (as celery, radishes, cress, etc.). Careful inquiry of the individuals of the above series has failed to indicate any habit of the kind, a habit rather unlikely in persons of their station (but by no means excluded by social status); but all were more or less open to infection by drinking surface water, either from ponds, streams, or surface wells, into which, by drainage, there must, especially in a loose soil, be frequent opportunity for the entrance of ova or embryos. The writer cannot set aside suspicion in connection with cistern water, into which there must often be the chance of entrance of ova, which have been deposited by wind and dust upon the roofs of houses, subsequent rains washing them into the cisterns. Stiles' conclusion as to difficulty of incubation when the ova are submerged is opposed to such an idea; yet the writer would point out that in the bottoms of most cisterns in our Southern sand districts there is to be found an ideal mixture of sand, mud, and charcoal (the last added with a view of purifying the water) in which, aside from the submersion, the ova might well develop.

Recently the view (held as early as 1898 by Loos after a personal experience) of entrance of the embryos through the skin of the host with a probably active penetration to their natural habitat in the intestine has been advanced and fully proved by experimentation upon dogs and human subjects by Loos in connection with the old-world hookworm.\(^1\) Independently, Bentley,\(^2\) having found in the fluid of a vesicle of ground-itch an embryo strongyloid which he identified as uncinaria duodenalis, arrived at the idea that "ground-itch" or "wateritch" is the product of invasion of hookworm larvæ into the skin, bear-

Centralbl. f. Bakteriol. u. Parasitenk., September, October, 1898; ibid., May, 1901; ibid.,
 February, 1903; Sandwith, Journ. Trop. Med., December 15, 1902.
 British Medical Journal, January 25, 1902,

ing with them various bacterial infections, the latter determining the type and severity of the dermal attack; in the study of which he produced experimentally conditions of the same character by application of moist soil containing uncinaria embryos to the skin of human beings. Various persons have correlated these ideas, and the view that the ground-itch described by Bentley (foot-itch of coolies, water-itch, panighao, etc.) is a precedent of uncinariasis has met with considerable favor. Whether the eruptive inflammation discussed under the name of ground-itch is of uniform origin and nature is, however, questionable, its reference to other infections than uncinariasis being common. It may be accepted, however, that hookworm larvæ do find access to the human host through the skin, and in their entrance undoubtedly cause more or less irritation, which may, perhaps, lead to an active vesicular and pustular dermatitis as seen in ground-itch, probably varying in aspect and severity from factors other than the parasitic embryos, and not necessarily representing more than one group of the cases known under the name of ground-itch. No experiments, as far as the writer's knowledge extends, have been undertaken in this relation of the large of the Armeiran hard the second but the large of the Armeiran hard the second but the large of the Armeiran hard the second but the large of the Armeiran hard the second but the large of the Armeiran hard the second but the large of the Armeiran hard the second but the large of the Armeiran hard the second but the large of the second but the large of the tion with the larvæ of the American hookworm; but there are reasons for belief that as much may be said in relation to it and the well-known "ground-itch" or "water-itch" of our Southern States, as has been stated in the above-outlined conclusion. The ground-itch of the southstated in the above-outlined conclusion. The ground-itch of the southern United States is extremely common among those who are accustomed to go barefoot, especially in moist, sandy places; it is especially common among children, usually affecting the feet and ankles, but also seen about the hands and wrists, and is by no means always associated or followed by symptoms referable to uncinariasis. It is, unfortunately, much confused with a number of somewhat similar affections, as the lesions caused about the toes by the penetration of the "chigoe" or "chigger flea" (pulex penetrans) and other minute arthropoda. Inquiry of the subjects included in the series of this paper has failed to elicit any history of any such dermal inflammation within the period of the patient's recollection, save in the last case (G.), who, after working for a period with much constancy in his parents' garden, had a severe attack of the affection about the hands and wrists—and this at a time compatible with the supposed time of infection with the hooktime compatible with the supposed time of infection with the hookworm larvæ.

Note. The writer, in view of the length of the present article, would leave further consideration of the subject, particularly including the symptomatology of uncinariasis in its American form and the structural changes following the presence of these worms, to a future contribution. This he is especially desirous of doing, although a section of the present paper as submitted for publication was devoted to semeiology, because

shortly before reading the proof he met a fatal instance of parasitism by the old-world type of hookworm, which promises to prove interesting in comparison with the disease as found in ordinary American cases of uncinariasis, and which he hopes to be able shortly to present to those interested in the subject.

THE OCCURRENCE OF UNCINARIASIS (ANKYLOSTOMIASIS) IN SOLDIERS OF THE UNITED STATES ARMY!

OF SAN FRANCISCO, CAL.

BY CHARLES F. CRAIG, M.D.,
FIRST LIEUTENANT AND ASSISTANT SURGEON, UNITED STATES ARMY; PATHOLOGIST AND BACTERIOLOGIST TO THE UNITED STATES ARMY GENERAL HOSPITAL, PRESIDIO

THE great interest which has attached to the discovery by Stiles that uncinariasis (ankylostomiasis) is a very common disease in the southern portion of the United States, that it is due to a new genus called by him uncinaria americana, and the fact that the disease occurs frequently in the Philippine Islands and is being imported into this country in the persons of soldiers of the United States Army returning upon almost every transport, has led me to believe that the cases which have been observed at the Army General Hospital at San Francisco. Cal., during the past eighteen months should be reported somewhat in extenso. Since January 1, 1902, there have been twelve cases of infection with uncinaria at this hospital. This number includes only those in which the ova were demonstrated in the stools. Several cases besides these have come here with a diagnosis of uncinariasis, but I have been unable to confirm the diagnosis. This small number of cases must not be considered as being an index of the prevalence of the disease in the Philippines. From conversation with several medical officers who have made examinations of the feces in those islands, I am convinced that the disease is very prevalent and forms a considerable portion of the causes of admission to hospitals. Many of the cases occurring in the Philippines are returned to duty, having recovered from the infection, and only the most persistent cases are received here.

. HISTORICAL. To First Lieutenant Bailey K. Ashford, Assistant Surgeon, United States Army, belongs the credit of having first called the attention of American physicians to the occurrence of this disease in Porto Rico, where he found it very prevalent. Since his publications numerous investigators in this country have reported cases, but it remained for Stiles to prove, by a series of careful and brilliant re-

¹ Pablished with permission of the Surgeon-General U.S. A., from the annual report of the bacteriological laboratory of the United States Army General Hospital, Presidio of San Francisco, Cal.

searches, that this disease is very common in the Southern States, especially among the so-called "dirt-eaters." Stiles believes that the latter symptom, i. e., dirt-eating, is due to the perverted appetite caused by the irritation of the uncinaria to the mucous membrane of the intestine.

As regards the occurrence of the disease in soldiers of the United States Army, cases have been reported by Ashford, Strong, Curry, and Brown.

In the following report I shall first give the clinical histories of the cases which have been observed here, followed by a description of the parasite and a few remarks upon etiology, diagnosis, and treatment.

CLINICAL HISTORY. Of the twelve cases observed, eight recovered and were discharged from the hospital, three are still in the hospital, and one died. For the following clinical histories I am indebted to First Lieutenants and Assistant Surgeons Edger and Grubbs, and Contract Surgeons Porter, Shepard, and Ashburn.

Case I.—A. H. W., aged twenty-seven years; birthplace, England; admitted to this hospital January 21, 1902; diagnosis: ankylostomiasis. Patient had been sick in hospital since October 11, 1901. No record is given of symptoms from which he suffered while in Manila. The only physical signs of importance were his distended abdomen, a yellowish-white skin, and anemic mucous membranes. The tongue appeared clean. The chief thing complained of by the patient was the accumulation of gas in the stomach and bowels, with eructations and more or less colicky pain. His appetite was good, bowels regular, although somewhat inclined to constipation.

The feces were examined on January 24th, and a few uncinaria ova were found. On February 3d they were again examined, and no ova were demonstrated. Patient was discharged from the hospital to duty on March 4, 1902, no ova having been found in the feces since January At the time of his discharge he had gained ten pounds in weight; the mucous membranes were more normal in appearance, and

the patient stated that he felt perfectly well.

Case II.—J. P. S., aged twenty-nine years; birthplace, Chicago; entered this hospital February 17, 1902. Patient was admitted from the United States Army Transport "Meade," and stated that he had been sick since November, 1900; had suffered from constipation, accompanied by vertigo, dyspnæa on exertion, and a sense of pressure over the chest. He had also suffered from occasional pains under the left scapula and along the left side. On admission the patient appeared very pale and anemic, the skin having a lemon-yellow lue. On examination of the heart a systelia marmar was detected which taking ination of the heart a systolic murmur was detected, which, taking into account the anemia present, was evidently of hæmic origin. The abdomen was somewhat distended, and the patient complained considerably of flatulence. The chief symptoms complained of by the patient on admission were general weakness, vertigo, dyspnæa on exertion, and palpitation of the heart. The feces were examined on May 15th, and a few uncinaria ova were found. They had been previously examined on February 26th, and were found negative. Patient was returned

to duty on May 21st, the ova having disappeared. During his stay in

the hospital the patient gained sixteen pounds.

Case III.—W. C. S., aged twenty-four years; birthplace, Maine; entered this hospital October 13, 1902; diagnosis: chronic gastroenteritis. Patient had been sick since December, 1901, suffering from acute diarrhea, having six to eight bowel movements in twenty-four hours with some blood. Also had abdominal pain of a colicky nature, and much gastric distention. Upon admission the patient complained of epigastric tenderness and flatulence. He had some diarrhea, but never passed any blood. He was weak and emaciated; the skin anæmic, as well as the mucous membranes, the abdomen distended, and the ankles somewhat ædematous. The feces were examined on October 14th, and were negative. Examined again on October 29th, when a few uncinaria ova were found. This patient remained in the hospital until November 13th, when he deserted, and no further record could be obtained in the case, but before desertion the ova had disappeared from the feces.

Case IV.—M. S. H., aged thirty years; birthplace, Iowa; entered this hospital October 13, 1902; diagnosis: chronic dysentery and ankylostomiasis. The clinical record in this case is very brief, it being impossible to obtain any data from it as to the symptoms from which patient suffered. The only physical sign noted is a distended abdomen. Feces were examined on October 23d, when numerous uncinaria ova were found. On November 15th a few were prescut, but frequent examinations after this period were negative. The patient was returned to duty on December 10, 1902, his illness having begun in June, 1902. During his stay in the hospital the patient gained ten pounds in weight.

CASE V.—A. L., aged twenty-two years; birthplace, Kentucky; entered this hospital October 13, 1902; diagnosis: estivo-autumnal malarial fever, chronic amæbic dysentery, ankylostomiasis. Patient's illness began in August, 1902. He had a severe diarrhœa, passing blood-stained mucus. Suffered severely from colicky pains in the abdomen and from abdominal distention. On admission he was much emaciated and very weak. Was having numerous bowel movements, the stools being thin and watery, with but little mucus and no blood. Patient complained mostly of abdominal distention and colicky pain. . Physical signs were those of anæmia, the skin being yellowish in color, the mucous membranes pale, and upon anscultation a slight hæmic murmur was heard over the larger vessels, especially in the neck. feces were examined on October 14th, and a few uncinaria ova were found, together with a few embryonic worms. On October 16th the patient had a chill, accompanied by the symptoms of malaria, and examination of the blood showed a few full-grown tertian parasites. This condition was quickly remedied with quinine. The patient deserted on November 22d, and no further history of the case is obtainable. The feces were negative for ova before desertion. ing his stay in the hospital he gained forty-one pounds.

CASE VI.—G. C. D., aged twenty-one years; birthplace, Virginia; entereed this hospital October 31, 1902; diagnosis: ankylostomiasis. Patient's illness began in September, 1902. The only symptom he complained of at that time was diarrhea, which continued until October 15, 1902. Upon admission the patient appeared somewhat anemic, but otherwise about normal. He complained of constipation, flatulence,

and slight tenderness over the abdomen. The physical signs were negative, save for a distended abdomen. He was returned to duty on February 24, 1903. The feces were examined on November 11th, and a few uncinaria ova were found: On December 12th the feces were

again examined, and were negative for the ova.

Case VII.—W. D. C., aged twenty-two years; birthplace, Kentucky; entered this hospital October 31, 1902; diagnosis: ankylostomiasis. Patient's present illness began about July 1, 1902, the symptoms complained of being diarrhea and general muscular weakness. Physical signs were negative, except for a slight anæmia. The only symptoms complained of by the patient while in the hospital were muscular weakness and pain over the right kidney. Had no diarrhea while in this hospital, and gained eight pounds in weight. His feces were examined on November 1st, and a few uncinaria ova were found. The feces were again examined on November 15th, and no ova were demonstrable. Patient was returned to duty on December 2, 1902.

Case VIII.—C. A. L., aged thirty-three years; birthplace, Sweden; entered this hospital January 8, 1903; diagnosis: ankylostomiasis. Patient's illness began August 28, 1902, as an attack of acute gastritis, which recurred on September 12, 1902. These attacks were followed by vertigo, tinnitus aurium, and dyspnæa on exertion. Upon admission to this hospital the patient complained of vertigo, tinnitus aurium, chronic nasal catarrh, and a cough. Physical examination showed anæmia, an acute bronchitis on both sides, and a distended abdomen. This patient still remains in the hospital, the infection being very persistent. From the time of entrance to the present time his feces have been examined repeatedly, and the ova persisted in them until June 20, 1903, despite all treatment. On January 24th he had a slight convulsion, which at that time was supposed to be epileptic in character. Since then he has had several epileptiform convulsions. Since entering this hospital he has gained thirty-one pounds, but still appears anæmic, and states that he is far from feeling well. The chief symptoms complained of have been those already mentioned, together with colicky pains in the abdomen, distention and flatulence, and more or less headache.

Case IX.—H. E. M., aged twenty-four years; birthplace, Michigan; entered this hospital April 28, 1903; diagnosis: dysentery (chronic amæbic) and ankylostomiasis. The patient's illness began December 10, 1902, as a colic, which recurred frequently, usually just before meals. He stated that this was relieved by lying on the stomach for about three minutes. He also suffered from alternating diarrhæa and constipation. His condition on admission was very good, although he was slightly anæmic. Had had no signs of any digestive disorder for two weeks. His feces were examined on April 29, 1903, and a few uncinaria ova found. They were examined repeatedly after this period, but no ova were found. Patient was discharged from the hospital June 15, 1903, to duty. He gained five pounds in weight while in hospital.

CASE X.—G. B., aged twenty-seven years; birthplace, Victoria, B. C.; entered this hospital April 28, 1903, and still remains under treatment; diagnosis: ankylostomiasis. Illness began December, 1902, the chief symptoms being diarrhea, the movements containing some blood and mucus. Patient also had severe abdominal pain and distention.

He had four such attacks of diarrhea before going to hospital. Upon admission the patient presented no symptoms whatever of ankylostomiasis, the only thing present being a very slight anæmia. The feces were examined and a few ova were found. Are negative at

present.

CASE XI.-G. C. C., aged twenty-eight yeras; birthplace, South Carolina; entered this hospital April 28, 1903; diagnosis: ankylostomiasis. Patient's illness began March, 1902, as a diarrhea. Three days after commencement he passed considerable blood and mucus. The highest number of bowel movements has been thirteen in twentyfour hours, accompanied by severe abdominal pain. On admission the patient's general condition was fair, but there was considerable anæmia present. The chief symptoms complained of were flatulence and abdominal distention. He had a slight diarrhea, bowel movements numbering three or four in twenty-four hours. Upon physical examination the heart was found to be somewhat irritable and irregular. A slight increase was noted in vocal fremitus over the upper portion of The abdomen was distended and somewhat tympanitic, the right lung. and the patient complained of slight soreness upon palpation. The feces were examined on May 6th and a few uncinaria ova were found. Repeated examinations have since been made, but were always nega-Patient still remains in the hospital under treatment.

CASE XII.-J. H. C., aged twenty-five years; birthplace, Germany; entered this hospital April 13, 1902. This is the only fatal case of uncinaria infection which occurred at this hospital. He entered the hospital from the Discharge Camp at Angel Island on April 13, 1902, and died April 15, 1902. As the patient became delirious soon after admission, no history could be obtained from him as to his previous condition. It was found upon examination that he had been a patient in this hospital from October 2d to October 14, 1901, with a transfer slip diagnosis of aukylostomiasis. At that time he was pale and cachectic in appearance, and his bowels were constipated. After a short stay in the hospital the patient was discharged. Upon entrance the patient was very anemic, respirations were labored, there was a slight delirium, and upon a careful examination the spleen was found somewhat enlarged. About 1.30 A.M. on the night after admission he had a severe chill, which was not accompanied, however, by any rise in temperature. His respirations were very labored, and this condition continued until his death at 10 P.M. on the night of April 15, 1902. No examination of the feces was made at this time on account of the lack of opportunity.

The following is the record of the pathological findings in this case: Body that of a man aged twenty-five; well developed and very little emaciated; finger-nails not congested; very slight post-mortem discoloration over the dependent portions of the body; skin of a lemon-

like hue; pupils dilated and equal.

Thoracic and Abdominal Cavities. Subcutaneous fat and muscular tissue appear normal. Pleural cavities are free from fluid. The liver reaches to the lower border of the last rib. The greater omentum reaches to the bladder and contains a large amount of fat. The mesenteric glands are considerably enlarged. The appendix lies upon the brim of the pelvis and appears normal. The abdominal cavity contains a small amount of clear, yellow fluid. The bladder is almost filled

with urine. Suprarenal glands appear normal, and upon section of the abdominal aorta no sclerosis is observed. All of the viscera appear

nearly bloodless.

Liver. The liver measures $22\frac{1}{2} \times 27$ cm. Weight, 960 grammes. It is very pale in color externally, the capsule is smooth, and the right lobe is slightly indented by the ribs. The gall-bladder is almost filled with dark olive-green bile, and no calculi are present. Upon section the cut surface of the liver is a very pale yellow in color; the lobules are, as a rule, indistinct, but some of them show slight venous congestion. The entire organ is extremely anæmic in appearance, the blood oozing from it being almost like water, the color index only 32.

Spleen. The spleen measures $15 \times 7\frac{1}{2}$ cm. Weight, 150 grammes. It is bright pink in color externally, the capsule is smooth, and the notches are distinct. Upon section the cut surface is dusky red in color, the Malpighian corpuscles invisible, and the interstitial fibrous tissue not increased in amount. The consistence of the organ is below

normal.

Pancreas. The pancreas measures $18 \times 3\frac{1}{2}$ cm. Weight, 130 grammes. It is very pale in color externally, and upon section the cut surface is almost white. Very little blood is visible in the organ. The consistence is somewhat decreased.

Left Kidney. The left kidney measures 11½ x 6 cm. Weight, 200 grammes. The organ is very pale in color externally, somewhat lobulated in appearance, and the capsule smooth. Two small cysts are present on the upper end. Upon section the cut surface is very pale in color, the cortex and pyramids being indistinct; this is due, however, to the anæmia rather than to changes in the parenchyma of the organ. The cortex is slightly thickened and there is a large amount of fat at the base of the pyramids. The mucous membrane of the pelvis is not congested, and the capsule not adherent. There are a few small cysts found upon the anterior surface of the organ beneath the capsule.

Right Kidney. The right kidney measures 12 x 5 cm. Weight, 160 grammes. It is light pink in color externally, the capsule is smooth, and no cysts are present. Upon section the cut surface appears very anemic, but the cortex and pyramids are distinct. The cortex is thicker than normal, and there is considerable fat at the base of the pyramids. The mucous membrane of the pelvis appears much congested;

the capsule is not adherent.

Lungs. The left lung is crepitant throughout, the lower lobe showing considerable hypostatic congestion. Upon pressure on this lobe, a large amount of bloody serum oozes from it, the blood being very thin and of low-color index. The right lung is adherent to the chest wall over the lower lobe and the lower portion of the upper lobe by very firm adhesions. The organ is crepitant and somewhat ædematous. Upon section of the organ a large amount of serum oozes from it on pressure.

Heart. Pericardial cavity contains about 100 c.c. of clear, straw-colored fluid. The apex of the heart is formed by the left ventricle. The amount of extracardial fat is greater than normal. The extracardial bloodvessels are somewhat congested. Coronary arteries appear normal. Upon section of the left heart the left ventricle is seen to contain a small, slightly yellowish clot, the auricle containing a red clot. The mitral valve appears to be slightly thickened, but is com-

petent. The aortic valve appears normal, as does the aorta above the valve leaflets. The muscular wall of the left side of the heart is slightly increased in thickness and very anemic in appearance. Upon section of the right heart the right ventricle is found to contain a red clot. The tricuspid and pulmonary valves are normal. The muscular wall is slightly thicker than normal and the muscle appears very

anæmic. Weight, 620 grammes.

Intestinal Canal. The large intestine appears normal, save for an intense anæmia of the mucous membrane. Small intestine: the ileum appears normal, save for an intense anæmia of the mucous membrane. In the jejunum and the lower part of the duodenum numerous minute worms are found embedded in mucus and in the mucous membrane. Upon examination these worms are found to be uncinaria (ankylostoma) duodenalis. The worms are most numerous in the jejunum, only about twenty being found in the duodenum. The entire number of worms counted amounted to 280, but they were probably much more numerous, as in opening the intestine a considerable portion of the mucus in which most of the worms were embedded was washed away. The proportion of males to females was about 1:4. About two-thirds of the worms are embedded in mucus, which in many places is slightly bloodstained. A considerable number, however, are attached to the mucous membraue and upou being separated a small ecchymotic spot is observed at the point of attachment. These minute blood-stained areas are especially numerous in the jejnnum. The entire mucous membrane is intensely anæmic in appearance, and in many places there is an almost total atrophy of the valvulæ coniventes.

The stomach appears normal, save for an intense anæmia of the

mucous membrane.

Anatomical Diagnosis. Secondary anemia due to uncinaria (ankylostoma) duodenalis. Subacute parenchymatous nephritis. Ascites. Hypostatic congestion of the lungs. Œdema of the pericardium and

slight venous congestion of the liver.

Microscopic Examination. Upon microscopic examination of the viscera, no characteristic lesions could be determined. The mucus in the intestinal canal showed numerous ova and almost invariably red blood corpuscles. Examination of the worms found showed them to belong to the European species.

ANALYSIS OF SYMPTOMS. General Development. In all the cases observed at this hospital the disease occurred after the period of adult life was reached, and, therefore, the lack of development noted by various authorities in persons in which the disease had occurred in early life was absent. All the patients were well-developed men, but emaciation was present in about half the cases.

Skin. In all of the cases a marked anamia was present, the skin appearing of a pale, somewhat lemon-tinted color. In none of the cases was there observed the shrivelled appearance of the skin described by Stiles. In one case the skin was of a normal white color.

Head. In none of the cases observed at the hospital did there appear to be any ædema of the face, which has been noted as a common symp-

¹ Bull. No. 10, Hyg. Lab., U. S. Pub. Health and Mar. Hosp. Serv., Washington,

tom by most authorities; neither could it be determined that the face had the anxious or stupid appearance which Stiles' speaks of.

In his elaborate article upon uncinariasis, Stiles2 notes the following symptoms affecting the eyes: The pupils either are dilated or they dilate readily, while the conjunctiva appears dull, dry, and of a chalky white. He also calls attention to the following phenomena observed by staring directly into the patient's eyes, he, meanwhile, looking intently at the investigator. Stiles says: "After a moment, the length of time apparently varying slightly according to the length of the disease, the pupils dilate and the patient's eyes assume a dull, blank, almost stupid, fish-like, or cadaveric stare, very similar to that noted in cases of extreme alcoholic intoxication." He states that he noted this peculiar condition in all the cases of uncinariasis he observed except two, and that he failed to find this condition in patients suffering from anemia not due to this disease. He, however, does not go to the extent of stating that this stare is diagnostic of the disease. In the cases which have occurred here I have investigated this symptom and agree with Stiles in finding that it is present in almost all cases; only one case observed here failed to present it.

Conjunctive and Mucous Membranes of Nose, Lips, and Gums. In all the cases observed there was a marked anemia of the conjunctive and the mucous membranes of the nose, lips, and gums. This was more noticeable, of course, in the most severe cases.

Tongue. In all but one of the cases observed here the tongue appeared clean, the only exception showing a brownish-yellow fur, rather thick, with small purplish-black areas scattered along the dorsum of the tongue. These spots were, as a rule, circular in shape and appeared to extend into the epithelial lining of the tongue. Some authorities have laid special emphasis upon these blackish spots as being diagnostic of the disease. From my experience here I would not consider these spots as of much significance, for only one out of twelve cases presented them, and I have observed the same condition in cases of dysentery, tuberculosis, and valvular disease of the heart. I believe the spots to be due, in all probability, to a venous stasis in the affected areas.

Trunk. The cervical pulsations were very distinct in nine of the twelve cases, so much so that they could be observed at some distance. The thorax did not present anything characteristic of the disease. The abdomen presented one of the most characteristic physical signs of uncinariasis, this condition being present in every case observed here. This characteristic physical sign is distention of the abdomen, giving the appearance commonly known as "pot-belly." This distention is

due to an accumulation of gas in the intestines, caused by lessened peristaltic action, and in some cases it is further aggravated by the accumulation of fluid within the abdomen.

Upon palpation of the abdomen, tenderness over the region occupied by the stomach; transverse colon, and small intestine was present in nine of the twelve cases, the epigastric tenderness being most marked.

In four of the cases distended venules were present over the abdominal wall, giving the abdomen a marbled appearance.

Extremities. Only one case observed at this hospital presented any symptoms which could be referred to the extremities. This one case showed a slight ædema of the ankles. According to most authorities, ædema is a common symptom in the worst cases of this disease, but in the case here in which ædema of the ankles was present the infection was a comparatively mild one. In the only fatal case occurring here ædema of the extremities was not present, although there was considerable ascites.

Respiratory System. One of the most common symptoms present was dyspnæa, especially prominent during exertion. Every case observed complained of this symptom, and in three of the cases it was so severe as to occasion the patient's great agony. In these latter cases the condition seemed to come on in paroxysms after even the slightest exertion. As regards the number of respirations, there seemed to be no general rule which could be deduced. In some of the cases the respirations were slower than normal, but in a larger number the respirations were above normal, varying between twenty and forty per minute. Only one of the cases observed here presented any symptoms of bronchitis, in this case the condition being a very prominent symptom. I do not believe, however, that the bronchitis was anything more than an accidental complication.

Circulatory System. The symptoms most prominent were anamia, the cervical pulsations, palpitation and irregular action of the heart, hamic murmurs, pain over the region of the heart, and irregularity in force and frequency of the pulse. Anamia was present in eleven of the twelve cases. It varied in intensity, being, of course, most severe in the long-continued cases of well-marked infection. As the blood counts in these cases will be given later, I shall not consider the numerical decrease at this time. As has been mentioned, the anamia was most easily observed in the mucous membranes, especially the conjunctive and the lips. The lemon-yellow hue of the skin has also been mentioned. Palpitation and irregular action of the heart were present in six of the cases. This condition was complained of in only two of the cases. Hamic murmurs were present in eight of the cases. In seven the murmurs were most noticeable over the carotids, and in only one was a murmur distinguishable over the heart. All of these cases showed a

considerable degree of anæmia. Pain over the region of the heart, characterized by the patients as a sense of pressure, was present in two cases. All the patients showing anæmia presented some irregularity in the force and frequency of the pulse. In all of them the force of the pulse was decreased, but it was noticed upon keeping the fingers on the pulse for some time that there were periods in which the pulsations were much more forcible. In six of the cases the frequency of the pulse was increased, varying from ninety to one hundred and ten. In two of the cases the pulse ranged between forty and fifty per minute.

Nervous System. Headache was one of the most prominent symptoms complained of by these patients. It occurred in all of the cases showing severe anemia, and was severe according to the extent of the anæmia. It seemed to be somewhat paroxysmal in character and was located, as a rule, in the frontal region or the occiput. In only one case was delirium observed, this case being the one that proved fatal. A condition of mental anathy was observed in six of the cases. This did not amount to an actual inability to comprehend, but seemed to be rather more of a disinclination to exercise the mental faculties. In his comprehensive article, Stiles' calls special attention to this condition, which, associated with the muscular weakness that is almost always present in these cases, produces a condition of laziness, which he considers the prominent symptom of uncinariasis in the Southern States. His announcement of this fact, unfortunately, gave rise in the daily papers to the statement that the organism of laziness had been discovered. Tinnitus aurium was present in two cases, and was very annoying to the patients. Vertigo was present in six of the cases, all of which showed marked anemia. Neuralgic pains, referable to various portions of the body, were present in five of the cases. The pain was most frequent in the knee-joints and shoulders. All the patient showing anæmia spent a large portion of the day in sleep, and, from my experience, I believe that this is a valuable symptom of uncinariasis.

Digestive System. The chief symptoms referable to this system were nausea and vomiting, abnormal appetite, constipation or diarrhea, and colicky pains in the stomach and bowels. Nausea and vomiting were observed in but one case, and were evidently due to a chronic gastritis. Disturbances in the appetite of the patient were observed in six of the cases, in all of which there was an abnormal craving for food. This condition led to a disagreeable sensation of emptiness and distention in the stomach. Marked flatulence was present in ten of the cases, and would appear to be a very common symptom of the disease. As far as can be ascertained from the records of the cases, there was no perversion of the appetite noted, none of the patients asking for unusual

articles of food, nor did any of them give a history of dirt-eating. Constipation and diarrhea were frequent symptoms in the cases observed Diarrhea was present in six, constipation in four, and the bowel movements were normal in two. It was not possible to determine whether or not the first attack of diarrhoea in those cases showing it was due to the uncinaria. As regards the stage of the disease in which the symptoms are most frequent, I would say that diarrhea is most frequent in the early stages and constipation in the later stages. In some of the cases, however, diarrhea persisted until remedial measures cured the infection. Every one of the cases observed here complained of colicky pains in the stomach and bowels. This condition was always associated with a distended abdomen, and was present from the very commencement of the infection. The colic occurred, as a rule, shortly after eating, and just before the movements of the bowels. I believe that the two most characteristic symptoms associated with the digestive system are distention of the abdomen and colic. Two of the patients complained of a severe throbbing pain over the stomach, and in both these cases there was present, in addition, very severe abdominal colic.

Muscular System. In five of the cases marked emaciation was present, being especially noticeable in the extremities. The remaining seven cases did not show any emaciation worthy of notice, but in all the cases the muscles were flabby and there was great muscular weakness present. A dull ache in the muscles was complained of, especially noticeable on awakening in the morning and after any continued exertion. There was also present a lack of inclination to exercise, and if exercise was taken the patient tired very easily.

Temperature. In only two cases was there any rise in temperature noted. In one the temperature oscillated between normal and 100° F., and in the other, the fatal case, between 100° and 103° F., the latter point being reached just before death. I am unable to state that the remaining cases did not show any temperature, because the clinical data is not clear upon this point, but it is probable that in the cases showing marked anæmia the temperature varied in the same manner as it does in other cases of severe anæmia.

Urine. The urine did not show anything characteristic, being normal in every case except one, this being the fatal case. Just before death the urine showed considerable albumin and numerous hyaline and granular casts, together with pus cells.

Feces. In the cases showing diarrhea the feces were of semifluid consistence or fluid, varying in color from a light gray to dark brown, always contained mucus, and generally some blood. The majority of the specimens were of a dark-brown color, and contained considerable blood-stained mucus. In the constipated cases the feces were well

formed, and of a dark-brown color, also showing mucus. It was found that it was much easier to demonstrate the *uncinaria* ova in the formed feces than in the semifluid or fluid. In fact it required several examinations to demonstrate them in the fluid feces, and then they could only be found in very small numbers. In the portion of this report dealing with the diagnosis of the disease, I shall discuss more fully the methods of examination of the feces.

Blood. In every case showing anemia the blood was of a more fluid consistence than normal, in the worst cases being almost like water. The color in the worst cases was almost buff, while those cases which did not show so extreme a degree of anemia exhibited a gradual gradation from this very light buff color to the normal color of the blood. It was noticed that the blood coagulated very slowly, and in the fatal case coagulation did not occur until nearly half an hour elapsed from the time of taking the blood.

The Hæmoglobin. Stiles, in his valuable report, states that the hæmoglobin is more apt to be reduced in the early stage of the disease than in the later, and that the most chronic cases are more apt to have a high hæmoglobin average than are the acute. This statement has been well borne out in the cases observed at this hospital, as the following table will show:

Case.	Case.						D	Duration of infection.			Hæmoglobin		
1										3⅓ n	onths.	36 p	er cent.
2										27	+6	68	**
3										10	44	48	**
4							•			41/2	££	34	"
5										3	**	30	t t
6										2	**	82	**
7			·							4	**	40	**
8										51/2	**	45	fi
9			-							4	ri .	28	**
10			·		-					5	4.6	50	61
11	-	-			-	-		_		13		60	e e
12			·	•				ab	out		ars	20	64
										•			

As will be seen, the statement is borne out in every case except Case XII. This was the fatal case, and the patient undoubtedly died of a profound secondary anæmia, and, as will be seen by the blood counts which follow, the hæmoglobin was not very much reduced beyond the reduction in the red cells.

The Red Blood Corpuscles. In ten of the twelve cases which have occurred here poikilocytosis was present, and most marked in the cases which showed the most severe degree of anæmia. Numerous authorities have claimed that poikilocytosis is not, as a rule, present in the blood in cases of uncinariasis, but this has not been our experience here, nor was it the experience of Ashford, who found that it was present in

² Cabot. Examination of the Blood.

sixteen of his seventeen cases occurring in Porto Rico. Normoblasts and megaloblasts were present in eight of the cases, but in very small numbers. The reduction in red cells will be seen in the table of blood counts which follows.

The White Corpuscles. Differential counts were made of the white corpuscles, and the following facts were observed: first, that there was invariably an increase in the eosinophiles; and, second, that the polymorphonuclear neutrophiles were reduced in proportion to the increase of eosinophiles. These facts agree with Ashford's statements in regard to the white corpuscles.

The eosinophiles in all the cases showed a marked increase, but this is not at all diagnostic of uncinariasis. In my experience, it is observed in nearly all cases of infection due to animal parasites. Thus, it is present in tapeworm infections, strongyloides infections, trichinosis, and is a very common condition in amedic dysentery. While it should arouse our suspicions, the mere presence of eosinophiles is not at all diagnostic of uncinariasis.

The following table gives the blood counts in the cases observed at this hospital. The lowest blood count and hæmoglobin estimate observed here is given and the highest eosinophile count:

Case	2.			White cells.	Red cells.	Eosinophiles.	Hæmoglobin.
1	,			. 3,572,000	23,000	8 per ct.	26 per ct.
2				. 2,160,000	16,000	5 "	68 "
3				. 2,100,000	9,000	1.5 "	48 "
4				, 3,650,000	12,000	6 "	34 "
5				1,252,000	10,000	3 "	30 "
6			· ·	. 1,848,000	31,000	10 "	32 "
7				, 1,550,000	26,000	12 "	40 "
S				1,560,000	11,000	15 "	45 "
9				4,160,000	62,000	1.4 "	28 "
10		Ī		4,000,000	10.000	3 "	50 "
11		·	·	. 3,417,000	10,000	2 "	60 "
12		·		. 810,000	11,000	15 ''	20 "

As will be observed, leucocytosis occurred in all but one of the cases. This is not in accordance with the observations of most authorities, and is very hard to explain. The counts were made very carefully, and there could be no mistake in the results obtained. It may be that the chauge from a tropical climate to a cool climate, such as San Francisco, may account for the rise in leucocytes. Two of the cases observed were complicated with malaria, one showing a tertian estivo-autumnal infection, and the other a tertian infection.

There was no increase noticed in the large or small lymphocytes, nor were any myelocytes observed.

DESCRIPTION OF THE PARASITES. All of the cases observed here were infected with the old-world hookworm, i. e., anchylostoma duodenale or uncinaria duodenalis. None of the cases observed were infected with the new-world hookworm, uncinaria americana. As

the differentiation of these two parasites is of importance, I shall give Stiles' description of both.

"The old-world hookworm, unicaria duodenalis: Body cylindrical, somewhat attenuated anteriorly; buccal cavity, with two pairs of ventral teeth curved like hooks and one pair of dorsal teeth directed forward; dorsal rib not projecting into the cavity. Male, 8 mm. to 11 mm. long; caudal bursa, with dorsomedian lobe and prominent lateral lobes united by a ventral lobe; dorsal ray divides at a point two-thirds its length from its base, each branch being tridigitate; spicules long and slender. Female, 10 mm. to 11 mm. long; vulva at or near posterior third of body. Eggs, ellipsoid, 52μ to $60 \times 32\mu$, laid in

segmentation. Development direct without intermediate host.

"The new-world hookworm, uncinaria americana, Stiles, 1902, of man: Body cylindrical, somewhat attenuated anteriorly; buccal capsule, with a dorsal pair of prominent semilunar plates or lips and a ventral pair of slightly developed lips of the same nature; dorsal conical median tooth projects prominently into the buccal cavity. Male, 7 mm. to 9 mm. long; caudal bursa, with short dorsomedian lobe, which often appears as if it were divided into two lobes, and with prominent lateral lobes united ventrally by an indistinct ventral lobe; common base of dorsal and dorsolateral rays very short; dorsal ray divided to its base, its two branches being prominently divergent, and their tips being bipartite; spicules long and slender. Female, 9 mm. to 11 mm. long; vulva in anterior half of body, but near equator. Eggs, ellipsoid, 64μ to 76μ long by 36μ to 40μ broad, in some cases partially segmented in utero, in others (rare), containing a fully developed embryo when oviposited."

Habitat. In small intestine of man.

As will be seen, the chief differences from a practical standpoint between these two worms consists in the vulva in the female of uncinaria duodenalis being situated at or near the posterior third of the body, while in the uncinaria americana it is situated in the anterior half of the body, the armature of the mouth, the buccal cavity in the uncinaria duodenalis having two pairs of ventral teeth and one pair of dorsal teeth projecting forward, while in the uncinaria americana the buccal capsule is provided with a dorsal pair of semilunar plates or lips, and a ventral pair of slightly developed lips of the same nature, and a dorsal conical median tooth projecting prominently into the buccal cavity, and in the size of the eggs. The eggs of the uncinaria americana measure from 64μ to 76μ long by 36μ to 40μ broad, while in the uncinaria duodenalis the eggs measure 52μ to 60μ long by 32μ broad. It will thus be seen that the eggs of the American specimen are much larger than those of the European.

The Ova. I shall describe here only the ova of the European species, as all of my cases were infected by this variety of the parasite. The ova are deposited in the intestinal tract of the patients and are discharged in the feces either unsegmented or partially segmented.

These ova are of the measurements already named, are ovoid in shape. enclosed by a thin, hyaline-appearing, and very distinct membrane. This membrane never appears of a double outline, and is generally perfectly regular unless the ova are degenerated. Within this hyalineappearing membrane, and placed at some distance from it is a granular mass of material which, at various stages of the development of the ovum, exhibits differences in structure. In those ova in which segmentation has not begun this granular mass appears homogeneous in structure, but where segmentation has commenced the mass is divided into more or less numerous granular clumps according to the stage of segmentation. When well advanced each granular clump or cell will be seen to consist of a granular protoplasm surrounding a small hyaline-appearing nucleus. The granular material consists of very distinct, refractive granules, much larger than those which occur in the protoplasm of any of the cells of the human body. As segmentation advances, a complete embryo is finally formed, but the ova escaping in the human feces never show any embryos within them, this development occurring after the feces have been exposed for some time to the air. It should be remembered that the ova of uncinaria never develop into embryonic worms within the intestine, it being necessary that they should first be deposited externally to the body. It therefore follows that for every adult worm present in the human body a separate embryo must have entered it.

METHODS OF INFECTION. Probably the most important method of infection is by swallowing the worms in infected food or drinking water. One very common method of infection occurs in persons who handle dirt in infected localities, and, because of uncleanly habits, contaminate their food or convey the infection directly to the mouth with the hands.

A method of infection which has received much study is that through the skin. This theory, which has now become established, was first announced by Looss. He discovered that if water containing embryos of uncinaria was placed upon the skin an itching sensation was produced, due to the worms entering the hair follicles, from which region they entered the surrounding tissues. At first this theory was received with a great deal of skepticism, especially when he announced that from the skin the larvæ finally reached the intestinal canal. Despite this skepticism, however, Looss has absolutely proved by experiment that this actually occurs, and not only by experiment on the lower animals but upon man himself. He found that in the case of a man who offered himself for such experiment, his feces having been examined for weeks previously, the application of infected material to his arm resulted in the appearance of the ova of uncinaria duodenalis in the feces on the seventy-first day.

By the experiment of Bentley the condition known as "ground-itch," occurring in some tropical regions, has been shown to be probably due to infection with uncinaria. This, however, has not been definitely proven, but is worthy of attention.

The theory propounded by some authorities that the larvæ of uncinaria can reach the human being through the respiratory tract, being present in the air, has not received any definite proof, and, so far as the present status of the case is concerned, it is not a probable method of infection.

Diagnosis. The diagnosis of uncinariasis (ankylostomiasis) depends upon the finding of the ova of the parasite in the feces. While the clinical symptoms are in some degree characteristic, they are not sufficiently so as to render a diagnosis of this infection conclusive by reference to them alone.

METHODS OF EXAMINATION. The best method of examining the feces for the ova is to select a small portion which is smeared upon a clean glass slide, if necessary, mixed with a little water and covered with a cover-slip. The specimen should be examined with a 1/6 objective and a one-inch eye-piece. Care should be taken not to have too much light upon the object, and, if the examination is not positive, several slides should be prepared and examined. To one who has seen the ova it is impossible to mistake them for the ova of any other intestinal parasite. Those most apt to be mistaken are the eggs of ascaris lumbricoides, oxyuris vermicularis, and strongyloides intestinalis. No difficulty will be experienced in differentiating the ova if any good work upon the intestinal parasites is consulted.

In certain cases, especially in those in which the feces are of a fluid consistency, or where the ova are in very scarce numbers, some method of sedimentation is necessary to demonstrate them. The method I prefer is as follows: A small quantity of the feces is taken and mixed with the requisite quantity of distilled water to make a very fluid consistence. This mixture is then placed in a centrifuge and allowed to rotate for from three to five minutes. The liquid is then poured from the top of the tube, and with a slender pipette some of the sediment is obtained from the very bottom of the tube. This is then placed upon a slide, diluted, if necessary, with sterilized water, and examined. If the ova are present this method will almost invariably demonstrate them.

Where a centrifuge is not obtainable the method of sedimentation recommended by Stiles' is most valuable. This consists in taking one or two ounces of feces, adding enough water to make from a pint to two quarts, shaken thoroughly, and the floating matter poured off, as well as the water down to the sediment. This washing is repeated

several times until no floating matter is observed. The last time it is done the mixture is poured into a small conical graduate, and after settling the sediment is examined.

In examining feces for *uncinaria* ova it will be found that the well-formed stools are most liable to result positively, and in such cases a small portion of the feces should be taken from the surface of the stool and, if possible, from any mucus present.

Where there is any doubt as to the presence of uncinaria ova in a given specimen it is well to place the feces in an incubator and to examine it after from twenty-four to thirty-six hours, when the young embryonic worms will be found.

Blotting-paper Test. Stiles recommends this test when the microscopic examination of the feces is impossible. It consists in placing a small portion of the feces upon white blotting paper and allowing it to remain for from twenty minutes to several hours. Upon removal "it leaves upon the paper a reddish-brown stain, similar to a blood stain." This method, while it may be practicable in a certain class of cases, is, it seems to me, of very limited application. I have found that the feces from a large number of various disease processes will leave a brown stain upon blotting paper, and this is especially true of the very class of cases in which a differential diagnosis is of most importance. Thus, the feces of chronic diarrhea, chronic dysentery, both amobic and specific, and chronic colitis often give a brown stain on applying this test. If a diagnosis of uncinariasis was made in such cases, it will he seen how incorrect and injurious to the patient it would be. Certainly in the class of cases received at this hospital this test is of little

Prognosis. It may be said that, as a rule, the prognosis in cases of uncinariasis is favorable if properly treated. To be sure, deaths often occur from this disease, but it will be almost invariably found that such cases have not received treatment, or, if treated, that the measures taken have not been thorough. That the disease is not one which is very dangerous to life is shown by the large number of cases in which the infection has lasted for years, but on account of the great debility produced by it this infection is of great economic importance. One has only to read in the valuable report of Stiles the condition produced in a certain class of the population of our Southen States by this infection to realize at once the great importance of its prevention.

Treatment. I have had no experience in the treatment of this infection, and can only speak from the experience of others. I believe that it is the concensus of opinion that thymol is the best drug as yet discovered for the treatment of this disease. It is usually given in the

following manner: The patient is kept in bed for a day or two before the drug is administered, and on as light a diet as possible. At the end of this time one gram (fifteen grains) of thymol is administered, followed in about two hours by the same dose. After from two to six or eight hours or longer a saline cathartic is administered, preferably magnesium sulphate. The stools should invariably be examined for the worms, as otherwise no statement can be made as to the result of the treatment. Larger doses of thymol are advocated by many; thus, two grams may be administered at once, followed by another two grams in two hours. The stools should be examined again in a week, and if, after repeated examinations, no ova are found, a cure may be expected. If, however, the ova are found, the treatment should be repeated.

Numerous instances are on record in which thymol produced alarming symptoms, and some authorities, notably Sandwith, believe that death has occurred from the use of this drug. It should be given with caution, and for this reason I have recommended the smaller dose. In one case which I observed here I believe that the drug caused a marked depression of the heart, which almost ended in collapse.

In all but one of the cases treated here, excepting the fatal case, the use of thymol resulted in a complete and rapid recovery. In this one case, however, repeated treatment with the drug has been pursued over a period of six months, and the ova of the parasite are still present, although in smaller numbers in the feces.¹

In the general discussion of treatment of this disease it is proper to speak of the methods to be adopted for its prevention. So far as the army is concerned, these methods consist in the proper disposal of the excreta, careful attention to the cleanliness of the person, especially the hands, the wearing of shoes in regions in which the natives are infected, and the boiling of the drinking water.

As the ova of this parasite develop in the feces after they have been voided, it will be at once seen how necessary the proper disposal of such matter is. The various methods of such disposal are well known to army surgeons, and will not be discussed.

As in a large majority of the cases infection is undoubtedly due in the human being to uncleanly habits, particularly eating with dirty hands, too strict attention cannot be paid to this item of personal cleanliness. The hands should invariably be washed before each meal, and, if possible, in hot water.

As Looss has shown that the infection can travel through the skin to the intestinal canal, it is obvious that going barefoot in an infected locality may lead to infection. Therefore, in such localities, shoes should be always worn.

¹ Since writing the above the ova have disappeared and the patient has been discharged from the hospital.

It is unnecessary to speak of the importance of boiling the drinking water, as this is so necessary a procedure in tropical climates, and also in many regions where water-borne disease is suspected, that it is invariably carried out whenever possible. Where the boiling of the water is impracticable, some method of filtration or sterilization should be adopted.¹

TUBERCULOSIS OF THE TONSILS AND THE TONSILS AS A PORTAL OF TUBERCULAR INFECTION.

BY HENRY KOPLIK, M.D., of NEW YORK.

THE tonsils have long been a subject of investigation as a seat of tuberculosis, and the literature is quite voluminous on this theme. Orth and Cohnheim first called attention to the fact that these organs might not only be the seat of tuberculosis, but that they were potent factors in the dissemination of this infection throughout the body. observations on tuberculosis of the tonsils and the conclusions drawn from them differ because one set of observers has studied the disease from a purely clinical standpoint, while the other has analyzed pathological and autopsy material. Pluder and Fischer examined a number of hypertrophied tonsils excised from the living subject; recently Lartigau and Nicoll examined a large number of adenoids. Any conclusions drawn from such material must necessarily be imperfect, for concealed tuberculosis elsewhere in the body would escape confirmation. Tuberculosis of the tonsil may be a primary isolated process unaccompanied by tubercular foci elsewhere. This is exceedingly rare; the only case of the kind in the later literature is that of Friedmann. case the patient was one year and four months of age; the tonsil alone was affected, the child dying of other causes. Other authors (Orth, Ruge, Schlessinger, Scheibner, Kruckmann) speak of primary tuberculosis of the tonsil with accompanying tuberculosis of the cervical lymph nodes. In these cases the disease was limited to these organs, or may have spread thence and then involved other organs. In one case published by Ruge the tuberculosis involved the tonsil and lymph nodes of the neck and caused also secondary cervical spondylitis, the lungs having escaped. Other cases are published by Schlenker, Brugmann, Friedmann, and Orth, in which the tonsillar affection was the starting point of an acute miliary tuberculosis or of a chronic pulmonary tuberculosis of the lung. The secondary forms of tuberculosis of the tonsil

¹ Since writing this report six more cases of uncinaria infection have been observed here, all infected with the European species.

are very common (Strassmann, Ruge, Dmochowski, Schlenker). victims of chronic pulmonary tuberculosis sooner or later develop This form of tonsillar tuberculosis is only of passtonsillar infection. ing interest. In both the primary and secondary forms of tuberculosis of the tonsil the cervical lymph nodes are quite constantly affected. Children furnish by far the greatest quota of cases, not only of primary tonsillar tuberculosis, but the form of the disease in which the tonsil draws into the infection the cervical lymph nodes. In some cases the tonsil is to external appearances normal; in others it may be hypertrophied (Lewin, Pluder, Fischer), the external surface showing no erosions or ulcerations. In a few cases the affected tonsils were even atrophied (Walsham). These atrophied tonsils when examined were found, as in the other forms mentioned, to contain tubercle tissue and tubercle Ulcers on the tonsil of a tubercular nature have only rarely been observed. In all the forms the cervical lymph nodes may be enlarged. When such is the case, the largest nodes and those supposedly first infected are found high up behind the tonsil. The affected nodes form a packet, stretching from behind the angle of the jaw along the great vessels toward the clavicle. The youngest diseased nodes are found behind the great vessels in chains. They are often very numer-The cases of primary tuberculosis of the tonsil confirmed by autopsy in the later literature may be summarized as follows:

One case mentioned in this paper of isolated tonsillar tuberculosis in a young child observed by Friedmann. Two other cases by the same observer of tonsillar tuberculosis with involvement of the cervical lymph nodes. Two cases in children of Kruckmann, with tuberculosis of the cervical lymph nodes. Two cases by Schlenker of tuberculosis of the tonsil and the accompanying lymph nodes in adults. Four cases of 60 examined by Scheibner of possible primary tuberculosis. case by Ruge, mentioned above, in a girl aged eighteen years. Pluder and Fischer, on the other hand, examined the tonsils of 32 patients which had been excised for hypertrophy and found tubercular infection in 5. Lartigau and Nicoll found 10 per cent. of 85 adenoids were the seat of tubercular tissue and bacilli. These were mostly children, the tonsils alone being examined. The other organs clinically revealed no tuberculosis. These authors give a résumé of 161 cases of Lermoyez, Gottstein, and Brindel examined in the same way. In 19 of these cases the tonsils were found to be tubercular and to contain tubercle tissue In those cases in which the excised tonsils alone are examined, the diagnosis of primary disease of the tonsil must necessarily be only provisional. In this respect such investigations must remain incomplete. It must be admitted, however, that if changes in the tonsil are old, the presumption of primary nature of the disease is strong in the absence of marked signs of affection of the lungs or

other organs. In this sense only the author wishes to report in this connection a case of apparently primary disease of the tonsil, peculiar in that the development of the affection dates distinctly from an exposure to infection. Both tonsils were involved. One tonsil showed a distinct tubercular ulceration which is rare, resembling in some respects a chronic diphtheria. Scrapings from the tonsillar ulcer revealed large numbers of tubercle bacilli. The granulations scraped from the tonsil showed tubercle with giant-cell formation. Examination of the extirpated tonsil on the left side showed the same tissue and bacilli. The lymph nodes on both sides of the neck from the angle of the jaw down were much enlarged, and when extirpated and examined showed the presence of cheesy areas, tubercle tissue, and numbers of tubercle bacilli. The nodes showing the oldest infection were high up behind the tonsil.

A. W., male, child, aged fifteen months; only child. Father and mother in good health. Patient has hitherto been in good health, with only an occasional bronchitis. Last summer, 1902, the parents took the child to Liberty, N. Y. The grandfather was stopping at this place, suffering from pulmonary tuberculosis. The child was with his grandfather quite a good deal and ate at the same table. In November, 1902, the child began to suffer from what the physician called tonsillitis. It was at this time in the city. In January, 1903, I saw the patient for the first time. The child was well nourished, slightly rachitic. It had congenital stridor. There was enlargement of both tonsils, especially the left. On this tonsil there was a ragged yellow ulcer, with an appearance resembling a pseudomembranous exudate. There were adenoids. At this time I found no bronchitis, no lung lesion. The cervical lymph nodes at the angle of the jaw were much enlarged. The color of the child was good. There were no enlarged nodes elsewhere. The patient with ordinary treatment for a tonsillitis improved. The pseudomembranous appearance of the ulcer on the left tonsil persisted for a time and then cleared up. The nodes at the angle of the jaw continued enlarged. Extirpation of the tonsils and adenoids was advised and carried out. On cutting the left tonsil, it was noticed that there was considerable resistance to the tonsillotome. As the surgeon expressed it, the tonsil had a cartilaginous consistency. After the operation the lymph nodes did not diminish in size-on the contrary. The old ulcer and pseudomembranous coating reappeared on the left tonsil four weeks after the operation. Scrapings taken from the ulcer on the left tonsil showed tubercle bacilli in large numbers, and the tissue scraped from the tonsil showed the structure of tubercle tissue. At this time the general condition of the child had improved and the patient had not lost in weight. The lungs did not show any areas of dulness. On the right side behind, over the lower portion of the lung, there were at times a few coarse râles (bronchitis?). There were at this time no enlarged glands elsewhere in the body; spleen and liver of normal size.

March 10. Nineteen pounds in weight a month after operation for adenoids and enlarged tonsils. Child had gained a pound in the past

month. Extirpation of the cervical lymph nodes on both sides and tonsil on left advised and carried out. The extirpated nodes on both sides were much enlarged, the oldest and largest nodes being behind the tonsil on both sides; the affected nodes stretched in a pocket as far as the clavicle.

The enlarged nodes on examination were seen to be the seat of tuberculosis. There was typical miliary formation of tubercle tissue with giant cells and numerous tubercle bacilli in the tissue. The lymph nodes on both sides showed the same pathological changes. Sections of the left tonsil showed tubercle tissue, though no cheesy areas, with very abundant tubercle bacilli.

The pathological examination was carried out by Dr. C. S. Bernstein, assistant pathologist of the Mount Sinai Hospital. Patient was examined two weeks after operation. The wounds on both sides were fast closing; the left wound had closed by primary union. The child, however, looked as if it had been through a severe operation. The lungs showed no areas of dulness, no bronchitis. There were no enlarged nodes elsewhere.

Two weeks later there was a loss of three pounds in weight, as compared to weight of the child previous to the operation. There was marked dulness over the lower lobe of the right lung behind. From the physical examination, therefore, there would seem to have been an invasion of the lung. The child died three weeks later with signs of pulmonary tuberculosis of the right lung and also of the larynx.

In the following case there was a packet of tubercular lymph nodes on the left side of the neck, without any accompanying lesion which could be demonstrated clinically. The enlargement of the lymph nodes dates from an affection of the tonsil. At the time of consultation the tonsil on the side of the affected lymph nodes was rather small, with an apparently normal surface. When removed the lymph nodes were found to be cheesy, broken-down, containing numerous tubercle bacilli. The largest nodes were just behind the angle of the jaw, adherent to the sheath of the internal jugular vein. A large number of small red nodes were extirpated, stretching in a chain behind the great vessels of the neck on the left side toward the clavicle. The nodes examined were found to be tubercular. The tonsil was not examined.

R. G., female child, aged twelve years. Father dead; cause? Mother in good health. Four other children in the family. A child younger than the patient is a delicate child nine years of age, seen by me in consultation. The diagnosis of lymphatism was made. Child ran a slight temperature, at times one degree above the normal toward evening. The only changes found were very slightly enlarged axillary lymph nodes, inguinal nodes, and cervical nodes. The patient, a sister of the above, had scarlet fever about a year before her visit, followed by an attack of diphtheria. Three months before the visit the mother noticed that the cervical lymph nodes on the left side at the angle of the jaw were enlarged. They have increased in size and now are as large as a walnut. Examination shows this mass to be made up of a number of lymph nodes. There are no enlarged nodes elsewhere. The examina-

tion of the lungs shows nothing positive. The percussion over the left apex in front seems slightly higher in pitch, but there are no râles and there is no change in the voice or breathing. The tonsils are normal in size and appearance. Weight of child seventy-one pounds. Slightly anemic.

Hæmoglobin, 65.7 per cent.; white blood corpuscles, 12,300; red blood corpuscles, 4,088,000; lymphocytes, 34.2 per cent.; large mononuclear, 1.6 per cent.; polynuclear neutrophiles, 63.4 per cent.; mast-

cells, 0.8 per cent.

Extirpated packet of a number of enlarged nodes and smaller ones showed that the nodes, the seat of advanced cheesy degeneration, were high up behind the tonsil, adherent to the internal jugular vein. Adjacent to the vein the nodes were broken down and cheesy; there were a large number of small red nodes stretching toward the clavicle. Histological examination of the nodes showed tubercle bacilli in the cheesy material. The nodes were the seat of tubercular changes.

Child now, six months after operation, is in good health.

In this case it seems an inevitable conclusion that the affection of the tonsil and infection of that organ was the starting point for the involvement of the lymph nodes.

As a portal of infection, there is no reason why the tonsil should not follow the rule and admit of tubercular infection, as it certainly does of pyogenic or diphtheritic infection. The tonsils in children especially are prone to be the seat of repeated inflammatory processes. During this period of life there is a tendency to the hyperproduction of adenoid tissue. Hypertrophy of the tonsils is very common. The tonsil, from its history during childhood, is anything but inactive. On the other hand, very little is known as to the exact method and avenues by which infection of the tonsil occurs. It is customary for one writer to repeat the other in telling us that the so-called leucocytic migration, which, according to Stoehr, is constantly going on in the follicles, is a potent factor in carrying bacteria from the surface of the tonsil to the interior of its crypts.

As to tubercular infection, Cohnheim, Orth, and most writers are agreed that the inspired air plays but an insignificant rôle, if any, and that the infection is brought about through the ingestion of infected food (Fuetterungstuberculose). The tubercle bacilli once implanted on the surface of the tonsil, it is still a matter of speculation how these bacteria work their way into the interior of the organ. It is inconceivable how, with a current of leucocytes directed from the interior of the crypts to the external surface of the tonsil (Stoehr), the bacilli gain entrance, granted that there are normal defects in the surface of the mucous membrane covering the tonsil (Hodenpyle, Stoehr). The theory is that the infectious material is drawn into the tonsil by the acts of swallowing. The question has arisen as to whether hypertrophy of the tonsil predisposes to tubercular infection. It would seem, from

the investigations of Pluder, Fischer, Gottstein, Lartigan, Nicoll, and others, that this was so, though tubercular infection is not as common as we would at first sight suppose, or as some writers would contend. Though some authors have found hypertrophied tonsils, extirpated in vivo, to be the seat of tubercular disease in from 5 to 15 per cent. of the cases, Friedmann has examined a large number of these extirpated organs and failed to find tubercular disease, even in the above small percentage of cases. We must conclude, therefore, that, on the whole, tubercular infection of the tonsil of a primary nature is uncommon; as an isolated infection it is exceedingly rare, for in most cases the lymph nodes communicating with the tonsil are drawn into the picture. There is no doubt also that these nodes become infected from the tonsil in the majority of cases—that is, from above downward. Of course, in marked tuberculosis of the bronchial nodes and the lungs the infection of the tonsil may take place against the direction of the lymph current, from below upward. Most writers contend, however, that this mode of infection is rare. Moreover, in the cases published in which this method of infection was supposed to have occurred it would be difficult to exclude the infection of the tonsils by the sputum, and thus of the lymph nodes from the tonsil.

The following case, which occurred in my hospital service, appears to me to illustrate the form of tonsillar infection first described by This child was admitted to my service with all the symptoms of tubercular meningitis. On admission also it was noticed that the lymph nodes on the left side of the neck at the angle of the jaw were enlarged. The tonsil on the same side could only be made out slightly enlarged, but otherwise with no abnormal appearances. After death of the child the tonsil was extirpated and, as the report shows, was the seat of tubercular changes and contained tubercle bacilli. enlarged nodes were examined and found to be broken down, cheesy, and the seat of old tubercular changes; there were numerous tubercle bacilli. The lungs, as most of the other organs, were only the seat of acute miliary tuberculosis. The above nodes were evidently the oldest seat of tubercular infection in the body. The bronchial lymph nodes were especially examined, to establish the presence of enlargement or old tuberculosis. A reference to the report of the pathologist shows that only one bronchial node was enlarged to the size of a bean, and was not the seat of tubercular changes. Here we have an evident case of infection through the tonsil of the cervical lymph nodes resulting ultimately in a general acute miliary tuberculosis.

J. S., male child, aged eight years. Diagnosis, tubercular meningitis. Family History. No history of tuberculosis. Patient is the third of six children, first two of whom are dead; cause unknown (both less than one year old). Other three children healthy.

Previous History. Born at full term. No rash on body, no conjunctivitis. No history of diseases of childhood until three months ago; at that time child had measles; ill ten days. No cough. After measles complained of pain in neck, and glands below left jaw became swollen (considerably); after a month swelling began to subside. No ear discharge; no sore throat; no cough. Had severe fright about seven weeks ago.

Present History. Child commenced to ail again about six weeks ago, having nothing but a little headache and fever from time to time. About ten days ago child felt very weak and complained of severe headache; this again disappeared. Since yesterday child is very stupid, but recognizes its parents and asks for food. No vomiting.

Constipated. No convulsions. Slight cough for past two days.

Status Præsens. G. C. poor. Fairly well nourished. Tongue moist and coated. Teeth and gums in good condition. Throat negative. Ears and mastoids negative. Pupils equal, dilated, do not react to light. Eyes move independently, causing various forms of strabismus. Very large glands beneath angle of jaw on left side, smaller ones in supraclavicular space, along anterior border of sternocleidomastoid; no glands elsewhere. Apparently hyperæsthetic. Tremor of hands, especially marked on voluntary motion. Rigidity of neck and slight retraction of the head. Kernig moderately marked; no signs of rachitis, but rosary. Babinski present of left foot, marked Macewen. Slight paralysis of left side of face. Hectic flush of cheeks. Tache cerebrale present.

Lungs—anterior. Dulness at left apex and in left axilla; harsh increased breathing at left apex and in upper part of left axilla.

Numerous subcrepitaut râles in right axilla.

Posterior. Dulness at left apex, extending to a point half-way

between spine and angle of scapula.

Heart. Upper border, third rib; right border, right border of sternum; left border, nipple line; apex-beat, diffuse; action, irregular, sounds good, no murmur; pulses, small, rapid, irregular.

Liver. Fourth rib dulness; flatness sixth rib to one finger below

free border; palpable at free border.

Spleen. Tympany over splenic area—spleen just palpable.

Abdomen. Lax, tympanitic, somewhat scaplioid, nothing palpable. Extremities. Patellar reflexes present; no ædema. Leucocytes 15,000.

Lumbar Puncture. 50 c.c. of clear fluid drawn off. Examination: Microscopic, many small mononuclear leucocytes; spreads, tubercle bacilli found; cultures, negative; albumin, increased one-eighth inch; sugar, negative; specific gravity, 1004.

March 21st. Child a little more conscious this morning. Paretic

symptoms remain the same.

23d. Child lies quietly in bed. No convulsions. Internal strabismus of left eye. Respirations irregular, sighing. Heart action irregular. Increase in size of left submaxillary glands.

The temperature in this case ranged from 101° to 102° F. during the week in which the case was under observation. At the close it

rose to 104° F.

Autopsy. Performed and reported by Dr. C. P. Bernstein, assistant pathologist Mount Sinai Hospital. Rigor mortis absent. Poorly nourished. Muscles red. No jaundice. No petechiæ. No ædema.

Thymus. Not enlarged; extending to level of sternal end of clavicles. Tonsils. Left tonsil considerably enlarged. Right tonsil about

normal in size, negative in appearance.

Larynx. On lower border of true cords, about one-third distance from their anterior attachment, are two small, distinct tubercles—one on each cord, not opposite. Rest of larynx negative.

Trachea. Negative. Esophagus. Negative.

Carotid Nodes. On left side could be distinctly seen and felt. On removal, the upper ones were found to be about the size of a walnut, soft, easily broken down, cheesy (spreads showed numerous tubercle bacilli). From above downward the glands gradually became smaller, lost their soft, cheesy character, until, at the clavicle, they were hard, on section not degenerated, and about the size of a pea. The individual nodes were considerably matted together.

On left side they could neither be seen, felt, nor dissected.

Lungs. Pleural cavities contained no fluid. A few fine adhesions at left apex. Parietal pleura negative. Visceral pleura studded with numerous solitary miliary tubercles on both lungs. Lung parenchyma thickly studded with tubercles. Both lower lobes congested.

Bronchial Nodes. Hardly enlarged, not congested, anthracotic; no

cheesy degeneration.

Heart. Pericardium negative. No increase of pericardial fluid. No tubercles. Heart itself showed some paleing of muscle. Mitral valve seat of a recent endocarditis, with fine miliary tubercles on auricular surface of edge. Otherwise flaps negative.

Aorta. Negative.

Coronary Arteries. Negative.

Ductus arteriosus and foramen ovale closed.

Liver. Surface and parenchyma studded with miliary tubercles. Organ normal in size; on section, hard and somewhat congested. Slightly fatty in appearance.

Gall-bladder. Negative.

Portal Vein and Ducts. Negative:

Spleen. Slightly adherent to abdominal parietes. Capsule wrinkled; organ normal in size, hard, not congested, pulp not easily stripped off. Miliary tubercles throughout parenchyma and on surface.

Kidneys. Normal in size, very flabby; capsule not adherent; mark-

ings distinct; slight clouding of cortex; otherwise negative.

Adrenals. Negative.

Ureter and Bladder. Negative.

Pancreas. Negative.

Intestines. Beginning at ileocæcal valve and extending almost to pylorus were many scattered tuberculous nodules, varying in size from the head of a pin to a small pea. Many of them were degenerated, allowing the expression of a drop of cheesy pus; some were ulcerated on the surface. Peyer's patches not involved. None extended beyond the submucosa. Mucous membrane throughout gut somewhat injected.

Colon and Stomach. Negative.

Mesenteric Nodes. Very slightly enlarged; slightly congested; other-

wise negative.

Brain. Veins of dura and sinus much congested. Considerable fluid in subarachnoid space. Very little ædema at base. Slight adhesions

between dura and caput at vertex. Dura mater and pia mater studded with tubercles. Ventricles (lateral), third and fourth, considerably dilated and filled with clear fluid. Choroid plexus also contained several tubercles, also floor of lateral ventricles. Otherwise, brain negative.

We have seen that the tonsil is the seat of primary tubercular infection, though rarely, as compared to the pyogenic forms of infection. The tubercular tissue is found in the form of giant cells and tubercular nodules; cheesy degeneration in the tonsil is not common; if the tubercle bacilli are abundant, it is exceptional; tubercular tonsillar ulcers are rare; as a rule, the lymph nodes leading from the tonsil are affected. Some of these tonsillar infections have been preceded by a simple catarrhal or diphtheritic inflammation of the organ. Tonsillar tuberculosis may be the source of a general tuberculosis of the body. As far as the cervical lymph nodes are concerned, when found, the seat of isolated tubercular infection, of a primary nature, it can be justly claimed that such infection has proceeded from the tonsil.

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THE ETIOLOGY OF NASAL POLYPI, WITH ESPECIAL REFERENCE TO THEIR ASSOCIATION WITH OTHER PATHOLOGICAL CONDITIONS.

By Francis R. Packard, M.D., of philadelphia.

On but few subjects in rhinological literature has there been more written than upon nasal polypi, and upon no subject does there seem to exist quite as much confusion in the matter of nomenclature. As

¹ Candidate's Thesis, American Laryngological Association, 1903.

these growths occur with such frequency, and lend themselves so readily to microscopic study, it is greatly to be regretted that more laboratory work has not been done in the effort to clear up their true nature. The real stumbling-block has been due to the fact that so many rhinologists have described them solely from their clinical aspects and without any effort to study their histology.

A brief study of the nomenclature employed in reference to nasal polypi is sufficient to convince us of the confusion or ignorance which exists in the minds of rhinologists as regards these frequently found tumors, and should stimulate us to a more scientific study of their pathological anatomy and of the morbid conditions producing or accompanying them. Jonathan Wright has recently contributed a most interesting résumé of the historical side of the subject, beginning with the views of the ancients and coming down to the most recent time, comprehending not only the work of rhinologists, but also that of the pathologists. It is unnecessary to quote from Dr. Wright's article at length, as it is readily accessible and should be consulted by those interested in its entirety. It is, however, of importance that we should direct attention to his authoritative statement as to the nonmyxomatous character of nasal polypi. He regards them as "pendent tissue in the nose which has assumed that shape because of the effusion of serum into it from the bloodvessels;" and after distinctly stating that they are in no way to be regarded as myxomatous tumors, he gives the following able summary of their true pathological histology: "While in the fluid of a polyp there is some mucin derived from glandular structure the polyp may contain, while here and there by careful focussing an occasional embryonal new connective-tissue cell may be seen, there is little or no new formation of tissue, but, on the contrary, a separation of the fibres of the pre-existing subepithelial stroma by serous effusion. In not a few cases these stroma fibres are so scanty, or the effusion of serum is so directly under the epithelium, that the coagulated fibrin threads form the sole framework of the tumor, holding a few leucocytes in their meshes." Goodale' has recently expressed the same view, stating that "true myxoma has not been reported from the nose." He regards nasal polypi as "circumscribed hypertrophies," and writes: "The stroma of these growths consists of more or less connective tissue, the meshes of which contain round cells and albuminous fluid. They are covered by a cylindrical epithelium which in places, exposed to external irritation, tends to become altered into pavement epithelium. The glands of the growth may be increased in number, having in the majority of cases the character of mucous glands. At times there occur in them so-called serous glands. The

¹ Trans. Amer. Laryng., Rhin., and Otol. Soc., 1901.

² A Treatise on Diseases of the Eye, Nose, Throat, and Ear, edited by Posey and Wright, 1902.

acini of the glands often show cystic dilatation, which may at times be so marked as to form a cyst occupying the greater portion of the growth." E. Fletcher Ingalls' likewise writes as follows: "Nasal mucous polypi are not myxomata, but outgrowths from the connective tissue of the nasal mucous surface, and hence are to be considered fibromata," representing "a hyperplasia in a state of ædema."

At the meeting of the American Laryngological Association in 1899 there was a symposium on the relation of pathological conditions of the ethmoid region of the nose to asthma. Dr. Henry L. Swain discussed the matter from a pathological standpoint. He stated that in his view nasal polypi were simply ædematous hypertrophies, and traced their etiology to hypertrophies of the turbinal tissue, which as a result of repeated attacks of congestion had become stretched and flabby, and as a result of their dependent position infiltrated with clear serum. Drs. Clarence C. Rice and E. Fletcher Ingalls wrote on the clinical phases of the relation of the ethmoid disease to asthma, pointing out the frequency with which they were found together. Dr. F. H. Bosworth, in the closing paper of the symposium, in writing on the subject, stated that he believed "polypoid degeneration of the mucous membrane of the nose, edematous hypertrophy of the mucous membrane of the nose, and nasal polypi all indicate and are clear symptoms of ethmoiditis," and he strongly urged rhinologists to bear in mind the fact that polypi were symptoms of an underlying ethmoiditis. The discussion of the four papers elicited the usual variety of views as regards the etiology and pathology of intranasal polypi.

The fact that they are not true myxomatous tumors is asserted by Kyle,² who, while dealing with polypi under the heading "Nasal Myxoma," states that they are the result of myxomatous degeneration of the mucous membrane and are in no sense new-growths. Bosworth,³ on the other hand, entitles chapter XVIII. of his book "Nasal Polypus or Myxoma," and writes: "The prevailing type of these tumors is that of pure myxoma, with certain more or less well-marked variations, attendant probably either on their immediate origin or perhaps on certain adventitions features of their subsequent development, surroundings, or life." Bosworth's classification is that which was used by J. Solis Cohen and Morell Mackenzie in their treatises, and is probably that which is most commonly adopted by the authors of articles on polypi in the current periodical literature.

In foreign rhinological literature the same confusion of terms exists. Zuckerkandl was inclined to regard polypi as adenomata, although, as

¹ Diseases of the Nose, Throat, and Ear, by Burnett, Ingalis, and Newcomb, 1901.4

² Text-book of Disenses of the Nose and Throat, 1901.

³ Treatise on Diseases of the Nose and Throat, 1893, vol. i. p. 387.

⁴ Normale und Pathologische Anatomie der Nasenhohle.

Bosworth points out, his classification included within its limits some formations which can hardly be properly considered as true polypi, such as hypertrophy of the mucous membrane covering the posterior extremities of the lower turbinates and papillomatous growths.

Probably no one man has done more to clear up the true nature of nasal polypi than Hopmann.1 He states that they are ædematous fibromata, basing this largely on their microscopic structure and on the fact that they react to heat in the same manner as egg-albumen, whereas mucin did not. Of late there has appeared a tendency among many rhinologists to revert somewhat in the direction indicated by Woakes,2 and attribute the existence of polypi to disease of the periosteum and osseous structure of the ethnoid cells. Thus Lambert Lack3 holds that a polypus is "a simple localized patch of edematous mucous membrane, and that this edema is a result of disease of the underlying bone." He has examined pieces of bone removed with polypi from over thirty cases, and in every instance has found a rarefying osteitis which commences with a proliferation of cells in the deeper layer of the periosteum. Accordingly he substantially agrees with Woakes in his theory of the origin of polypi as a result of bone disease, as did many other participants in the discussion in which he made this statement.

Grünwald' believes that "polypi in the majority of cases are almost as good as pathognomonic of empyemata of the accessory cavities or focal suppuration in the nasal passages." He sums up the results of his examination of eighty-two persons in whom polypi were observed—seventy-one of whom were certainly the subjects of focal suppuration. Grünwald states that "when Woakes maintains that he has never seen a case of nasal polypus in which he could not find necrosis he is contradicted by my experience as detailed above, but only in part. It is decidedly a one-sided view to refer all polypi to ethmoidal disease, seeing that other empyemata and focal suppuration are just as potent in causing them; in the same way Woakes' statement that he has never

¹ Hopmann's articles on the subject begin with a paper which he published in Virehow's Archiv in 1883, No. 93, and were followed by a number of contributions appearing subsequently, as follows: Monatsschrift f. Ohrenheilk., June, 1885, the Archiv f. Ohrenheilk., 1887, No. 5, vol. xxi. p. 124, wherein he announced his intention of publishing a series of articles substantiating his contention that polypi were ædematous fibromata and not myxomatous growths. These articles were entitled "Was ist man verechtigt Nasenpolyp zu nennen?" Beginning in vol. xxi., No. 6, p. 152, they continue through three subsequent numbers. He was incited to write these articles by the statement made by Kiesselbach in Monatsschrift f. Ohrenheilk., 1887, No. 4, vol. xxi. p. 89. Kiesselbach wrote a reply which was published in the Monatsschrift f. Ohrenheilk., 1888, No. 12, vol. xxil. This whole series of articles will well repay perusal.

² Laneet, 1885, No. 11, p. 108; Nasal Polypus with Neuralgia, Hay Fever, and Asthma in Relation to Ethmoiditis, London, 1887.

³ Journ. Laryng., Rhin., and Otol., February, 1901.

⁴ Treatise on Nasal Suppuration, New York, 1900.

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seen a normal middle turbinal can only be characterized as an incom-

prehensible exaggeration."

John N. MacKenzie¹ has made a thorough study of the pathological anatomy of ethmoid disease, based on careful microscopic investigation of the tissues removed from a case under his observation. Among his conclusions we find: that nasal polypi are not myxoma, nor are they the result of a myxomatous degeneration; that purulent ethmoiditis may continue for years without any involvement of the bone; that in the ethmoid and middle turbinated regions the ordinary nasal polypus is developed as follows: "The first stage consists in the formation of young granulation tissue, the result of inflammatory action. In the second stage this tissue becomes gradually converted into definite adult connective tissue, which in the third stage gradually separates and causes more or less complete obliteration of the normal structures, and in the fourth stage converts them into a fibrous mass." He says he cannot go as far as Grünwald in attributing polypi to suppuration. They are in the vast majority of cases due to inflammation. The presence of suppuration he regards as an incidental phenomenon, and as of secondary importance.

When we take into consideration the ample opportunity afforded for the study of intranasal polypi, one may well wonder at the diversity of the views expressed concerning their nature, and yet a thorough understanding of these growths is of the utmost importance to their proper treatment. Bosworth, in repeating Zuckerkandl's often-quoted statement that he had found polypi or polypoid degeneration in one out of every eight or nine autopsies, adds that in his own experience of 1418 cases of ordinary catarrhal disease seen in private practice 134 showed the presence of fully developed polypi, or about one case of polypus for every eleven cases of ordinary catarrhal trouble. Other statements might be adduced to strengthen the proof of their frequent occurrence. might be adduced to strengthen the proof of their frequent occurrence, but it is a matter of almost daily experience with rhinologists, and can, therefore, be passed by with the statement that their frequency should have led to a more complete knowledge of their pathological histology.

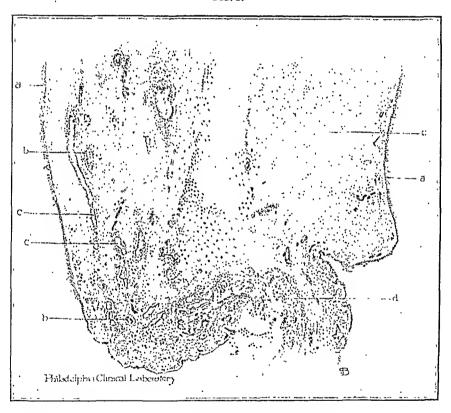
Another matter of common experience is the frequency with which

Another matter of common experience is the frequency with which they recur after apparently complete extirpation. This feature should certainly teach us the necessity of ascertaining the real cause of their presence in every case, and if possible removing it. This point I consider of particular importance, as I believe recurrence is especially frequent when polypi are the result of caries or necrosis of the ethmoid bone, and that they can only be finally extirpated by the removal of the diseased bony tissue. A most apt confirmation of this view has occurred to me in the last six cases of intranasal polypi which have

¹ Journ, Laryng., Rhin., and Otol., February, 1897.

come under my care in my private practice. Of these four presented a history of previous removal of polypi. In each of them both nostrils were more or less completely blocked by polypi, and after the removal of one or more of the growths rough bone could be detected with a probe in the region of the middle turbinate. The polypi were all removed, and with them a large part or the whole of the middle turbinate, and in every instance, although some months have elapsed, there has been no recurrence. In the two remaining cases there was no history of the previous removal of polypi, but in both of them there

Fig. 1.



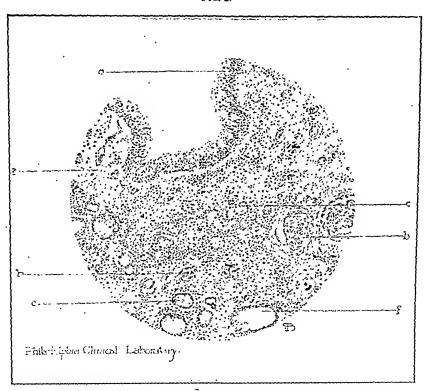
Nasal polyp drawn from author's specimen: a, epithelium; b, bloodvessel; c, gland; d, fibrous connective tissue; e, mucoid matrix.

was a suppurating ethmoiditis, and after removing one or two polypi I was able to remove dead bone from the middle turbinate region. There has been no evidence of trouble since. I am convinced that in all six cases the polypi were present as a result of the disease of the bone; that the recurrence in four was due to failure to recognize their etiology and remove the cause, and that they would have recurred again in all six cases had I not found the necrosed bone and removed it.

I have of late been making it a routine practice to have sections cutof every polypus which I remove from the nose. The accompanying two cases I submit as very typical in their clinical history and microscopic characteristics of the conditions under which nasal polypi generally present themselves.

Case I.—A man, white, aged forty years, who has always considered himself particularly strong and healthy, and could not recall ever having had any serious illness. Eight years ago fourteen polypi were removed from his nasal chambers. He says that at that time both nostrils were completely blocked, and that the removal of the growths seemed to give him absolute relief. For the last two or three years



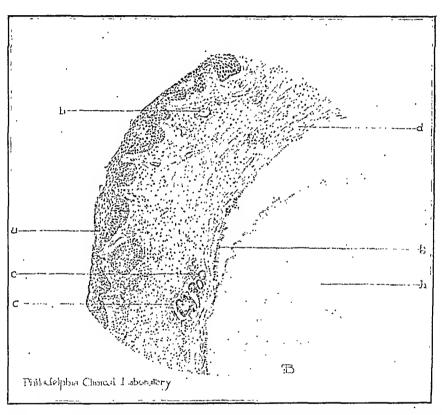


Nasal polyp drawn from author's specimen: a, epithelium; b, bloodvessel; c, gland; c, mucoid matrix; f, beginning mucoid degeneration of gland.

he has noticed increased obstruction to masal respiration. On examination polypi could be seen almost protruding from each nostril anteriorly. Under cocaine, with the cold-wire snare, I succeeded in removing in all eleven polypi from the left and four from the right nostril. Dead bone was felt with a probe in both nostrils in the middle turbinate region. The patient objected, however, strongly to further operative procedures for its removal. He is still under my care, and has lately told me that he would submit to the removal of dead bone owing to my repeated statements to him that I was sure the polypi would recur again unless thorough erasion of the bone was made.

Fig. 1 shows a section (under low power) of one of the polypi removed from his nose. The fresh tissues were fixed in Orth's fluid and embedded in celloidin. The section was from three to five microns in thickness, and was stained in Ehrlich's acid hæmatoxylin, with an eosin counterstain. Its gross appearance was typical of the ordinary nasal mucous polypus; as the section shows, it was covered with normal epithelium, and consisted of a mucoid matrix, with some fibrous connective tissue, and quite a few glands. Fig. 2 shows a field drawn from the same section under high power. The most interesting feature shown by it is the gland f, which was beginning to undergo a mucoid degeneration.

Fig. 3.



Nasal polyp from author's specimen: a, flat-celled epithelium: b, bloodvessel; c, gland; d, connective tissue: g, degenerated gland epithelium; h, mucoid degeneration with calcareous infiltration.

Case II.—A girl, aged eighteen years, was referred to me complaining of tinnitus and considerable deafness in the right ear; the condition had lasted for six months. She had had chronic suppurative otitis media in the same car when a child. Examination revealed a very much retracted, fibrous, and scarred right membrana tympani. The right nostril was almost completely filled both anteriorly and posteriorly with a mass of polypi. These were gradually removed at repeated sittings by the cold-wire snare; I also removed a large mass of necrosed bony tissue from the region of the middle turbinate. This patient has now normal hearing, and has no tinnitus in her right ear. Fig. 3 is a

section of a polypus removed from her nose. It was fixed in alcohol, then decalcified in nitric acid, embedded in celloidin, and stained in Ehrlich's acid hæmatoxylin, with an eosin counterstain.

Clinically it was most deceptive. When the wire came in contact with the calcareous material with which it was infiltrated I supposed that it was bony in character, as I had already removed dead bone from the same nostril.

In the numerous sections which I have cut there has been absolutely no evidence of anything in the nature of a true myxomatous tumor; on the other hand, mucoid degeneration was commonly found. In both these very typical cases which I have detailed the growth was associated with the presence of dead bone.

My object in presenting this present incomplete study of the subject is to add my mite to the work of those interested in establishing our clinical work on a scientific basis. I believe that if only sufficient attention is persistently directed to this important subject the heretofore prevailing laxity in nomenclature will disappear; and when rhinologists have learned that nasal polypi are symptoms of underlying conditions, and not "tumors," the mere removal of which will result in a complete cure, it will redound greatly not only to the credit of the profession, but to the benefit of the patient, by lessening, if not altogether abolishing, the frequent recurrence of polypi after their removal by operation.

HYPERTROPHIC TUBERCULOSIS OF THE LARYNX.

BY CLEMENT F. THEISEN, M.D.,

OF ALBANY, N. Y.,
LECTURER ON DISEASES OF THE NOSE AND THROAT, ALBANY MEDICAL COLLEGE.

The classical picture of laryngeal tuberculosis makes the recognition of this condition, as a rule, quite easy. The history of the case, the fact that there is in almost every case a pulmonary involvement, the finding of tubercle bacilli in the sputum or in scrapings from the larynx, the well-marked constitutional symptoms, and the steady advance of the pulmonary symptoms are factors which always clear up the diagnosis. Add to this the typical changes in the larynx, the infiltration, aphonia, and characteristic ulceration, and we have a symptom-complex which is practically peculiar to laryngeal tuberculosis only. The character of the ulceration particularly is the symptom in the clinical presentation which is peculiar to the type of tuberculosis of the larynx usually observed.

Hypertrophic or, as it may perhaps properly be called, hyperplastic tuberculosis of the larynx, which will be the only form of the disease considered in this paper, presents an altogether different clinical picture.

The following case observed by the writer is a good illustration of this very unusual type of laryngeal tuberculosis. This case is of particular interest because of the great diversity of opinion in regard to the patient's condition. He was seen by a number of laryngologists in different parts of the country and different diagnoses were made.

Mr. M. I., aged forty years, native of Germany, merchant, married, two children, consulted the writer February 19, 1901, for hoarseness that had existed for a year. His family history was negative, there having been no cases of tuberculosis so far as he knew. He had always been subject to colds. Syphilis was denied. His physical condition at the time was excellent, weight about 175 pounds, and he had only lost about five pounds during the past six months. He was very hoarse, the voice being decidedly weak; in fact, the aphonia was nearly complete. His appetite was excellent, and he had no night-sweats. He coughed very little at this time, and several careful examinations

of the lungs gave absolutely negative results.

We did not discover tubercle bacilli in the sputum, but Dr. Roarke, of Troy, who had also examined his larynx and made a diagnosis of tuberculosis, told me that a few had been found in a former examination. His nose, nasopharynx, and pharynx, with the exception of a chronic follicular pharyngitis, did not show any particular changes. His larynx, however, presented the following interesting condition: The mucosa was generally somewhat reddened, with a well-marked thickening in the interarytenoid space, which was firm to the touch. Both arytenoids were thickened and infiltrated, this being more marked in the left than the right. Both cords were thickened, and there was a circumscribed thickening of considerable size on the left cord near the processus vocalis. There were circumscribed hypertrophied areas on both ventricular bands, with broad bases, not presenting the appearance of new-growths, but rather of hyperplasia of the tissues. They were covered with a perfectly intact, smooth mucous membrane, and were of a grayish-red color. This was one of the interesting features of the case. The epiglottis was not involved, nor did the process appear to extend below the cords. There was absolutely no ulceration anywhere in the larynx. A diagnosis of laryngeal tuberculosis was made by the writer, in spite of the atypical laryngeal condition, and the negative examination of the lungs. The patient was told that he had a good chance for recovery in Denver. This favorable prognosis was given because his lungs at this time did not show any evidence of tuberculosis on physical examination. He started for Denver, but on the way consulted a well-known laryngologist of the West, who gave it as his opinion that the case was not tuberculous. I believe he was given potassium iodide for some time, with local treatment, but did not improve. (I would like to state at this time that this paper is not written in a spirit of criticism. The physician who examined him in the West did not know that tubercle bacilli had been found in the sputum. Nobody not knowing this could have made a positive diagnosis. Because, however, this case has already been published elsewhere as one of pachydermia laryngis, and on account of the different diagnoses that have been made, but particularly because the outcome of the case justified the diagnosis of tuberculosis, a thorough and impartial presentation of its clinical history was considered important.) The patient then returned to New York, where he was under the care of a laryngologist, and was seen by a number of others, one or two of whom agreed with the writer's diagnosis. The physician who treated him in New York reported the case as one of pachydermia laryngis (New York Medicinische Monatsschrift, November, 1901, p. 528). In this article he states that a laryngeal ulcer was discovered in Albany. This is an erroneous statement, because at no time while the patient was under the observation of either Dr. Roarke or the writer was there any evidence at all of ulceration. Repeated examinations of the sputum in New York failed to show the presence of tubercle bacilli. This fact was stated in a letter to the author by the patient's physician there, and the statement was also made "that as there were no signs over the chest, the case, if not pachydermia, could only have been primary tuberculosis of the larynx." The patient grew steadily worse, and was finally sent to Saranac Lake in June, 1901, where he was under the care of Drs. Trudeau and Baldwin. He died there August 4th, with well-marked laryngeal and pulmonary tuberculosis.

In answer to inquiries in regard to the patient's condition at Saranac, letters were received from Drs. Trudeau and Baldwin, from which I will give abstracts. (Dr. Trudeau's letter was in answer to an inquiry whether in his experience tuberculosis of the larynx often developed after pachydermia.) "I often find," he wrote, "that pachydermia laryngis coexists with tuberculous laryngitis, but I don't think I have ever had much reason to believe that the warty growths were anything more than a complication of the original tuberculous process." Baldwin sent me the following record of the patient's condition when seen by him June 10, 1901: "Advanced pulmonary and laryngeal tuberculosis, dulness on right apex, with prolonged expiration, moist râles to fourth rib." I also quote the following from his letter: "The patient came to me with fully developed pulmonary and laryngeal tuberculosis on June 10th, and died August 4th. Your letter indicates that he had more signs on left side of the larynx; by June, however, the right arytenoid and cord were more infiltrated, and there was some ulceration of the cords. He died without ulceration of the arytenoids or epiglottis." The writer has been careful not to call this even a probable case of primary tuberculosis of the larynx, although in other parts of the body this hypertrophic form of the disease sometimes precedes the lung involvement. In the larynx, however, primary tuberculosis is excessively rare, and I have always been of the opinion that it did not occur, because post-mortem findings have demonstrated the fact over and over again that tuberculous processes in the lungs had existed in cases of laryngeal tuberculosis, even though they were not discovered during life in the most careful physical examination. One of the only positive cases of primary laryngeal tuberculosis that I have been able to find in the literature is the case reported by Fraenkel (see

Duesberg's article³⁰). In this case the patient had been treated for five years for laryngeal tuberculosis. At the autopsy neither in the lungs nor in any other organ, except the larynx, was there any evidence of tuberculosis. This is one of the few cases on record in which the diagnosis was proved post-mortem. Cohen has reported three cases that were also probably primary. A résumé of the clinical history of this case brings out some interesting points, i. e., a tuberculous condition of the larynx that existed for a year and a half before any ulceration developed; the normal physical examination of the lungs up to the time the patient went to Saranac, the well-marked circumscribed hypertrophies of the ventricular bands, the decided thickened areas on the vocal cords, and the swelling of the arytenoids. This was of the nature of a thickening of the tissues, and not the edema usually found. Taking all these facts into consideration, I believe a diagnosis of hypertrophic tuberculosis was justified.

DIAGNOSIS. In considering the diagnosis of this unusual form of laryngeal phthisis, we must first dispose of the differential diagnosis of the writer's case from pachydermia, particularly as it was published as a case of pachydermia. The fact that a thickening of the vocal cords existed near the processus vocalis, a common seat for pachydermic masses, was not an argument for pachydermia in this case, because there was not only not the usual depression on the surface of the nodule, which is caused by the pressure of a nodule directly opposite on the other cord during phonation ("pachydermische dellen"), and which is characteristic of pachydermia, but, in fact, a node on the other cord opposite the one on the left cord did not exist. We have abundant authority in the literature of the subject for this characteristic appearance of the pachydermic node. Fraenkel,²⁴ Virchow, Symonds,²⁶ and others have described it as characteristic. Pathologically, pachydermia cannot be considered a condition sui generis, but merely a result of the chronic laryngitis of alcoholics, inveterate smokers, or a part of the clinical picture of tuberculosis or syphilis. I believe alcohol and tobacco are the two most important factors in producing pachydermia. writer's patient was a man of excellent habits.) Great stress is laid upon this by Sturmann. Really only the diffuse form of pachydermia need be considered in the writer's case. In this form the products of the hypertrophy of the epithelium very often break down rather easily, forming cracks or superficial ulcers on the surface of the pachydermic nodes. Habermann²⁷ mentions the frequency with which this ulceration occurs in pachydermia. He found it twenty-one times in fiftcen larynges. Moll²³ considers pachydermia simply a form of chronic catarrhal laryngitis. Zwillinger²⁸ thinks it is akin to leukokeratosis, and claims that the two conditions have the same etiology, and are identical clinically and anatomically. To conclude the differential

diagnosis of pachydermia and hypertrophic tuberculosis, then, we may exclude pachydermia when the characteristic circumscribed hyperplasia of the ventricular bands or other parts of the larynx is present, when we do not get a history of excessive drinking and smoking, when syphilis can be excluded, when the depression on the pachydermic node is absent (this was always present in cases observed by the writer), and when all other factors that would cause a chronic laryngitis can be excluded. In the writer's case the condition certainly simulated a diffuse pachydermia, but, as later developments proved, it was not pachydermia but tuberculosis all the time. It is much more difficult to make a diagnosis in a case in which carcinoma develops from or coexists with an apparent condition of pachydermia. Fraenkel,20 in his able article, thoroughly discusses this point, and in conclusion states "that carcinoma develops not infrequently from pachydermia." reports cases to prove this statement. General or circumscribed hyperplasia of certain parts of the larynx is characteristic of the form of tuberculosis under discussion, and this hyperplasia of the tissues occurs in other parts of the body, as well as a manifestation of hyperplastic tuberculosis. Lartigau, in his article "Hyperplastic Tuberculosis of the Intestine," etc., mentions this as the fundamental lesion. the most interesting and characteristic features of the intestinal form are the polypoid and papillomatous formations mentioned by Pilliet (Lartigau). These tumor-like formations are not very uncommon in the larynx, and a number of the recorded cases unquestionably belong to this type of laryngeal phthisis. In order to get a thorough idea of the diagnosis of this interesting form of laryngeal tuberculosis, it will be necessary to briefly review the cases in the literature. only a few on record with the title "Hyperplastic Tuberculosis," although I have been able to find a number of others that belong in this classification. If, for example, we give the term hypertrophic or hyperplastic tuberculosis its widest meaning, we must include certain forms of tuberculous tumor formations, in which the tumors are covered with intact mucous surfaces (although some ulceration may be present in some other part of the larynx), and in which the tumor developed before the ulceration. I do not think that tuberculous granulomata, for example, which develop at the site of an ulcer and which break down easily, belong in this class. I quite agree with Schech's statement that "tumors should only be called tuberculous in which earlier ulceration at the site of the tumor can be excluded."

The following classification of hypertrophic tuberculosis of the larynx is suggested by the writer as a convenient one. No arbitrary classification can be made. It is, of course, understood that no case will be included in which a positive diagnosis was not made. The following cases, although not entirely complete, are practically all that I could

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find in a thorough search of the literature in which the diagnosis of tuberculosis was proved:

Class I. Cases in which the characteristic changes in the larynx consist of either a marked hypertrophy or hyperplasia of the tissues, or in which tumor-like formations without ulceration occur.

Class II. Distinct tumors, usually covered with intact mucous surfaces, and called by the French the "type d'Avellis," which seem frequently to originate in the ventriculus Morgagni. These tumors may or may not be pedunculated.

CLASS I. The following rare cases, of which I will give brief abstracts, belong in this class:

John N. Mackenzie¹ reports two cases observed by him in the Rudolph Hospital, Vienna. The specimens, which were removed at autopsies by Dr. Hans Chiari, were examined by Mackenzie microscopically: 1. Tuberculous tumor of the trachea. Pharynx, larynx, and trachea free from ulceration. A circumscribed tumor was found in the trachea, about 1½ cm. above the bifurcation, and was about the size of a bean. A similar one was found in the pericardium. Microscopically the tumors consisted of tuberculous nodules set in a network of hypertrophied connective tissue. 2. Tuberculous growths of the vestibulum laryngis. Patient died of pulmonary tuberculosis. The epiglottis, aryepiglottic folds, and ventricular bands presented a remarkable granular appearance, due to the presence of small, smooth, dense, nodular growths. No trace of ulceration in the pharynx, larynx, or trachea. Microscopic examination disclosed the same appearances as in Case 1. He also describes tuberculosis of the laryngeal muscles, and reports a case in which large well-marked tubercles were found embedded in the muscular tissue and absolutely unconnected with the tuberculous infiltration of that part of the larynx. This case is extremely rare and bears out Heinze's similar investigations.

Foa's' case. Foa reports a rare case of this form of tuberculosis. I will give only the post-mortem findings. There was well-marked evidence of pulmonary tuberculosis as well as of the ileum and mesenteric lymph glands. In the larynx, at the base of the epiglottis, on its inferior surface, in the region of the arytenoids, and on the cords, there were numerous eminences, from 2 to 4 mm. long and 2 to 3 mm. wide. Absolutely no ulceration of the laryngeal mucosa. On microscopic examination the vegetations were made up mainly of connective tissue, and contained some giant cells and epithelioid cells. An inflammatory condition of the mucosa, with a well-marked hyperplasia, could be made out. Tubercle bacilli were found in portions of the tissue removed.

Lermoyez's³ case. A man, aged forty years, entered the Hospital Bichat in Gougenheim's service. Had had severe hemoptysis. There

was difficulty in breathing, marked aphonia, and inspiratory dyspnea. A large mass was seen in the larynx in the region of the cords. It was difficult to determine the exact point of origin. During inspiration the growth descended below the glottis. A tracheotomy was performed, and a large subglottic growth similar to a polypus was found. Patient died five days after the operation. At the autopsy a large mass, attached in the angle of insertion of the right cord, was found. This is rare in the history of tuberculous vegetations. There was tumefaction of the left cord and beginning vegetations.

Ariza has contributed several articles on this subject. In the first he simply and very incompletely reviews the literature, and describes the vegetative or hypertrophic form of laryngeal tuberculosis. There are sometimes enormous localized hypertrophies of the tissues. He also refers to the fact that there may be no ulceration in these cases. In the second article he mentions the great difficulty in making a diagnosis, and that the hypertrophy is seen chiefly in the ventricular bands and cords, and may be so extensive as to make tracheotomy imperative.

Doleris¹⁵ case. The patient, aged sixty-three years, had severe hæmoptysis and dyspnæa at night. Complete aphonia had existed six months. Death occurred suddenly, with symptoms of asphyxia. At the autopsy the following interesting changes were found in the larynx: There was marked hypertrophy of the entire mucous membrane, the thickening being so great that the lumen of the larynx was reduced to one-quarter the normal size; the cords were effaced. The epiglottis and aryepiglottic folds were thickened and there was some subglottic hypertrophy. Mucous membrane was very pale. There was slight ulceration in the region of the right ventricular band. Pulmonary tuberculosis was also found. There was marked sclerosis of areas of lung tissue and a formation of fibrous tissue. A cavity existed in the right lung as large as a small orange.

This is, perhaps, the most marked example of hypertrophic tuberculosis of the larynx on record.

Schnitzler's case. The patient, a young man, came to Schnitzler's clinic for the relief of urgent dyspnæa. Laryngeal examination showed the presence of several grayish-white tumors varying in size from a bean to a hazel-nut, not ulcerated, situated mainly in the ventricles of Morgagni, and almost completely filling the upper part of the larynx. Schnitzler makes the statement in this article that, laryngo-scopically, these tuberculous tumors had probably never before been observed, and later, in another article (Wiener med. Presse, November 16, 1884), he questions Dr. John N. Mackenzie's right of priority in describing such tuberculous tumors. Mackenzie's cases were certainly published before Schnitzler described the above case. It was seen by Schnitzler (see Crepon's article) in 1882, but it was not reported until

1884. Tracheotomy was performed by Billroth in Schnitzler's case, and then by an endolaryngeal operation the tumors were removed. Microscopic examination proved the diagnosis.

Dehio's' case. Tumor of the larynx; no ulceration. Tumor attached to left ventricular band by a broad base, covering the whole band. Great thickening of the right ventricular band. On microscopic examination no evidence was found of caseation of the tubercles. There were bacilli in the tissue removed for examination.

Henning's case. Man, aged fifty-two years; good family history. In the region of the left cord there was a round, smooth tumor, with a broad base, and covered with normal mucous membrane. The tumor covered the posterior two-thirds of the left cord, left ventricular band, and ventriculus Morgagni; probably originated in the ventricle. Laryngotracheotomy was performed. Diagnosis was proved by the microscopic examination.

Koch's case. Tuberculous tumor of the larynx removed by laryngo-tracheotomy. Diagnosis verified by microscopic examination.

Hopmann's cases. (Reported by Karl Becker.) 1. Tuberculous tumor of the anterior commissure; laryngotomy. 2. Tumors of the ventricular bands and cords; laryngotomy; death in two months from pulmonary tuberculosis. 3. Tumor of the anterior part of the right cord. Two operations were performed, and eleven years after the patient, who was a minister, had suffered no recurrence and could use his voice both for speaking and singing. (Remarkable case.) 4. Tumor nodules of the anterior part of the cords and the epiglottis. 5. Large tumor of the anterior commissure; pulmonary tuberculosis; operation followed by cure.

Küster's¹¹ case. Woman, aged forty-six years; prominent tumor in the anterior commissure. There was very slight ulceration in the larynx; a laryngotracheotomy was performed.

Josephsohn's¹² case. Reported as a case of primary tuberculosis, but as there was no autopsy it cannot be so called. Girl, aged twelve years, with marked tumefaction of the epiglottis and hard infiltration, with tumefaction of the arytenoids. Symptoms on the part of the lungs did not appear until shortly before death. There was slight ulceration on the posterior wall of the larynx.

Kidd's case is not included in this classification because there was some doubt about the diagnosis.

Castex¹³ has called attention to certain nodules occurring on the cords, to which he has given the name nodular tuberculosis. They frequently become tuberculous and are grayish-red in color.

CLASS II. While this class of pedunculated tumors can, perhaps, not be called typical examples of hypertrophic tuberculosis, they must be considered a form of the disease. Lartigau includes papillomatous

excrescences and polypoid formations as a type of hyperplastic tuberculosis of the intestine.

Billroth's 'a case. Two pedunculated papillary excrescences of the left cord, with a subglottic tumor. A diagnosis of epithelioma was made, but after the growths were removed tumors were found to be tuberculous; no ulceration in the larynx.

Pauzer's¹⁵ cases. (Reports three cases.) Two apparently ordinary polypi of the cords were found, on histological examination, to be tuberculous. In the third case there were papillary excrescences on the left vocal cord. In two of the cases the tumors occurred in otherwise perfectly healthy larynges.

Clark's 16 case. Woman, aged twenty-one years; no evidence of pulmonary tuberculosis. Had been hoarse for three years. Pedunculated tumor in the larynx attached to the left ventricular band. Diagnosis proved after removal of growth. No recurrence after a year and a half.

Kirkpatrick's¹⁷ case. Papillomatous mass in the interarytenoid fold. Diagnosis proved microscopically.

Bronner's¹⁸ case. Pedunculated new-growth attached to the left cord

Bronner's a case. Pedunculated new-growth attached to the left cord in a tuberculous subject. Found to be tuberculous on microscopic examination.

Sachs'19 cases. Two cases of laryngeal tumors with normal lungs. (He considered them primary, but I could find no record of autopsies.)

One of the most important works on the subject of tuberculous tumors has been written by Avellis.²⁰ He has reported thirteen cases observed by himself. There are cases belonging to both classes. tumors in his cases were circumscribed, and there was no laryngeal ulceration. He states that this form is probably sometimes primary. In this connection a series of cases studied by Moser²¹ is of interest. He describes cases in which practically the only evidence of laryngeal tuberculosis was the thickened and nodular epiglottis. As a rule, there was either no ulceration or very little in the larynx. Sometimes this same thickening was noticed in the larynx. Some of these cases are undoubtedly examples of hyperplastic tuberculosis. A case of lupus of the epiglottis has recently been reported by Chambers (Laryngoscope, February, 1903), which simulates somewhat Moscr's cases. It is of interest in this connection, because a section was sent to Dr. A. O. J. Kelly, of Philadelphia, who reported that the ease was one of hyperplastic tuberculosis. Jonathan Wright was more inclined to the opinion that it was lupus. Gougenheim and Tessier,22 in their admirable work, were the first to describe cases occurring in children, as "pseudopolypoid scleropapillary" forms. "La texture est toujours lamieme; ce sont les hypertrophies papillares, developpées sur la muqueuse tuberculeuse à l'occasion action irritative ou inflammatoire." These cases they claim

may sometimes be primary. As before stated, however, I believe that primary cases of this or any other form of laryngeal tuberculosis occur with extreme rarity. Fraenkel's case is one of the only ones I could find in which the diagnosis was verified by autopsy. It is possible that Hopmann's third case, in which there was no recurrence for over eleven years after the removal of a tuberculous growth, was primary. It is more than likely, if the lungs had been involved in this case, that the patient could not have lived so long without a recurrence. Dehio's case may also have been primary. There were, however, no autopsies in these two cases.

A study of the cases described in this paper would appear to the writer sufficient to clear up the diagnosis of the different forms of hyperplastic tuberculosis. A histological examination will usually settle all doubt, although there are cases in which the histological structure simulates sarcoma. Attention has been called by Koschier to the occurrence of rhinoscleroma associated with tuberculous infiltration of the pharynx and of both arytenoids. In connection with the diagnosis of the writer's case, this condition need hardly be considered. In the first place, rhinoscleroma is excessively rare in this country, and, secondly, primary scleroma of the larynx is very rare. every case the characteristic lesions in the nose will be found. Schrötter35 has also called attention to the occurrence together of scleroma and tuberculosis. Hypertrophic tuberculosis must also be differentiated from lupus, syphilis, sarcoma, and carcinoma. Lupus, as stated by Emil Mayer, is tuberculosis, but occurs in another form. from the form of tuberculosis under discussion in that in the larynx it usually involves the epiglottis. Primary laryngeal lupus is, too, extremely rare, although it has been mentioned by Mayer (New York Medical Journal, 1898). Macroscopically, lupus tissue has rather a different appearance. There are usually pale, elevated nodules, which sometimes ulcerate at their apices. These ulcers heal very slowly, and as one cicatrix forms another nodule may break down, giving a characteristic appearance which differs essentially from that of hyperplastic tuberculosis. A histological examination of lupus tissuc is not always of much help, and the diagnosis must often be made by exclu-The fact that the lingual surface of the epiglottis is usually affected first and the very slow course of the disease will assist in clearing up the diagnosis. Then, of course, in the vast majority of the cases lupus is a secondary process. True syphilitic tumors (syphilomata), when they occur in the larynx, present many more diagnostic difficulties. There is a form of syphilitic tumor which I have observed several times, which, like the tuberculous tumor, may or not be pedunculated, is covered with an intact mucous membrane, and may not break down for a long time. Such cases are extremely difficult to

differentiate clinically from hyperplastic tuberculosis. A history of syphilis can, however, usually be obtained, and, even if not, the administration of potassium iodide will settle all doubt. Syphilitic hyperplasia, which is made up simply of granulation tissue, quickly breaks down, forming the typical ulceration. This is true also of the syphilitic granuloma, which is simply an inflammatory condition that develops around an ulcerated surface, and of the gumma. From beginning carcinoma and sarcoma the hyperplastic form of tuberculosis can be differentiated by the histological examination. The further course of the disease and the typical laryngeal appearance in advanced carcinoma will clear up the diagnosis.

Exception may be taken to the writer's classification of hyperplastic If we were to include cases in which the larvngeal changes consisted simply of circumscribed hyperplasia or hypertrophy of parts of the mucosa we would have practically only Mackenzie's second case, Doleris' case, Foa's case, possibly Lermoyez's case, and Ariza's description of the condition. In all the other cases there was distinct tumor formation of some kind. I believe these cases should be included, particularly where there is absence of ulceration. Ulceration, however, may occur in some part of the larynx late in the course of the disease. When this occurs it does not affect the diagnosis of this form of tuberculosis in any way, because the characteristic lesions, the tumor formations, are not involved in the ulcerative process. In the writer's case, it is true, slight ulceration of the cords developed just before death, but the characteristic circumscribed hypertrophies of the ventricular bands and the thickened arytenoids remained unaltered. Tumor formation occurring in this form of the disease is, perhaps, nothing more than a circumscribed hyperplasia of the tissues, with the typical histological changes.

A review of the recorded cases of the forms of hyperplastic tuberculosis of the larynx described in this paper brings out some interesting facts. We find where the age of patients was mentioned that adults between the ages of thirty-one and sixty-three years were mainly affected. About an equal number of men and women had the disease. The youngest case in which this form of tuberculosis occurred of which I could find any record was in a girl, aged twelve years (Josephsohn's case¹²). Gougenheim and Tessier are among the only other authors who have described this form of tuberculosis in children, and Mackenzie¹ and Heinze³² are among the few authors who have described tuberculosis of the laryngeal muscles. The favorite sites for the laryngeal lesions are, in order of frequency, the vocal cords, ventriculus Morgagni, ventricular bands, epiglottis, arytenoids, and the anterior commissure. There was only one case in which the tumor formation was limited to the interarytenoid fold, and only two in which subglottic

tumors occurred. The ventriculus Morgagni alone was involved in two cases, the cords alone in six, the ventricular bands alone in two, the epiglottis alone in some of Moser's²¹ cases, and the anterior commissure alone in three. The epiglottis was involved with other parts of the larynx in three cases, the epiglottis and arytenoids together in one case, the arytenoids and cords together in one, and the ventricular bands and cords together in one. Mention is made of pulmonary tuberculosis in the majority of the cases. In the few cases before mentioned in which no evidence of pulmonary tuberculosis was found there is no mention of autopsies, so that this fact cannot be considered of much importance.

TREATMENT. Only one phase of the treatment will be considered, and that is a proper climate. I firmly believe, with Chappell, that any chance should be taken in a good climate, rather than the best treatment in a poor climate. The climate in the Hudson Valley, near Albany, is certainly poor enough. For this particular form of the disease proper treatment in a good climate would be ideal, because ulceration is either entirely absent or does not develop until very late in the course of the disease. I am convinced, in considering my own case, that if the patient had gone to Denver and remained there he would be alive to-day. Another important point to consider in such cases is that in these early forms physical examination of the lungs is sometimes negative. They are certainly more favorable cases for a change of climate than the cases of laryngeal tuberculosis usually seen.

Conclusions. (a) Hypertrophic or hyperplastic tuberculosis of the larynx must be considered a distinct and unusual form of the disease.

- (b) As a rule, there is no ulceration, but there may be some late in the course of the disease.
- (c) Ulceration may be present at the same time as the hyperplasia of the tissues in some part of the larynx, but the characteristic circumscribed hypertrophies and tumor formations do not break down.
- (d) It is practically always secondary to the pulmonary involvement, but there appears to be some evidence in support of the statement that particularly this form of tuberculosis may at times be primary.

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OBSTRUCTION OF THE BOWELS AND PERITONITIS DUE TO A STRANGULATED MECKEL DIVERTICULUM.

BY JOHN H. GIBBON, M.D., SURGEON TO BRYN MAWR HOSPITAL AND TO THE PENNSYLVANIA HOSPITAL.

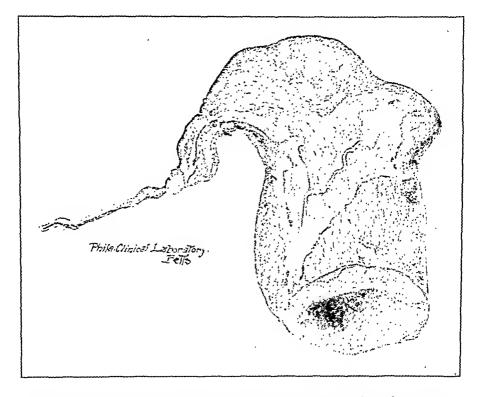
THE present-day method of early opening of the abdomen upon the presentation of certain symptoms which are considered indicative of operation has done much to advance the diagnosis of intra-abdominal conditions and to abolish the former frequent and indefinite diagnoses of "peritonitis" and "obstruction of the bowels." These terms for years have obscured a multitude of primary causes which are now being revealed and which formerly only came to light in the post-mortem room. Early operation has not only revealed the primary cause of the trouble, but it has done so at a time when the life of the patient could

be saved. It is seldom nowadays that an abdomen is opened for obstruction of the bowels, that the surgeon is compelled to make an artificial anus without discovering the cause of the condition, or that he is obliged to simply open and drain an abdomen for a suppurative peritonitis without finding and removing the primary condition which produced it; and yet how short a time since was this not the case? The findings on the operating table, much more than the findings in the post-mortem room, have taught us the early diagnosis of abdominal lesions; but, unfortunately, not enough to make us willing to withhold operation until a definite diagnosis is made, provided certain symptoms indicating operation are present. The physician or surgeon who must wait until he has made a positive diagnosis of an acute inflammatory or obstructive lesion before advising operation will save few of his patients. The cases of perforation in typhoid fever, of perforated gastric and duodenal ulcer, which have been saved have been, in the majority of cases, those in which there was some doubt as to the exact lesion.

The case here reported, although not one of early or correct diagnosis and treatment, is yet one which teaches their importance:

S. F., a girl, aged ten years, was admitted to the Pennsylvania Hospital on the night of November 10, 1902, and I saw her a very short time after her admission. Dr. Rosenthal, who sent the patient to the hospital, saw her first twenty-four hours before admission. The patient had been sick for one week with pain in the abdomen and progressive symptoms of obstruction of the bowels. The night before admission she was extremely ill with a temperature of 103°, a greatly distended abdomen, vomiting, and a weak and rapid pulse. Upon her admission she presented all the symptoms of an extensive peritonitis, with obstruction of the bowels. There was no marked rigidity of the abdomen, but there was more tenderness over the right lower quadrant. The abdomen was enormously distended. I concluded that the patient was suffering from a general peritonitis, probably due to appendicitis, and operated upon her at once. An incision was made in the right semilunaris, and when the cavity was opened there flowed out a quantity of turbid fluid. When the finger was introduced it came in contact with a mass of partially adherent intestine in the right iliac region. The pelvis, and in fact the whole abdominal cavity, was filled with a seropurulent exudate, and the small intestine was enormously distended. A large portion of the adherent bowel was covered with plastic lymph. After separating the adhesions there was exposed to view what was supposed to be the appendix, but it was observed that from the end of this tissue there passed a firm, fibrous band, which prevented its delivery. This fibrous band was traced in the direction of the umbilicus and then broken. The discovery of the fibrous band and the inability to bring the supposed appendix into the wound until it was divided caused me to believe that I was dealing with a Meckel's diverticulum. After the band was divided the diverticulum was easily delivered through the abdominal wound and the bowel to which it was

attached recognized as the ileum. The diverticulum was very much inflamed and covered with lymph; it was attached to the ileum about two feet from the cœcum, directly opposite the mesenteric attachment of the bowel. The portion of the bowel to which it was attached had been constricted by the diverticulum to such an extent that there was a distinct white ring extending over about one-half the circumference of the bowel, such as is frequently seen in strangulated hernia. It will be seen, therefore, that not only had the diverticulum produced an obstruction of the small intestine, but that it had itself been so compressed as to produce a degree of strangulation closely approaching gangrene. The diverticulum was about two inches long and of the same calibre as the bowel to which it was attached. In the process of separating and delivering the adherent bowel, a slight tear was made in



the ileum near the point of constriction; this was closed with two rows of continuous sutures. The diverticulum was then removed and this would closed in a similar manner. The entire small intestine was then withdrawn, the lymph removed, and the abdominal cavity thoroughly flushed with quantities of salt solution. The intestines were then returned and a gauze drain was passed down to the floor of the pelvis and another about the sutured intestine, which was left directly under the wound in the abdominal wall. A large quantity of salt solution was left in the abdominal cavity and only three sutures placed in the wound.

During the operation the patient's condition became very much worse, the pulse becoming so rapid as to be uncountable. Free stimulation, however, resulted in a good reaction and the patient made excel-

lent progress until the seventh day. At this time the packing had been entirely withdrawn and the patient seemed in a fair way toward recovery. On the evening of this day, however, there was a rise of temperature and a complaint of pain in the abdomen. There was no distention of the abdomen, and the bowels moved, and there was no vomiting. On the morning of the ninth day the temperature was 104°, and the patient was vomiting and complaining of more pain in the abdomen. Ether was given and an exploration of the wound resulted in the evacuation of about an ounce of pus from the pelvis. Drainage was introduced, the patient's stomach washed out, and she subsequently made an excellent recovery.

So much has been written during recent years upon Meckel's diverticulum and the pathological conditions which it may give rise to, that a further discussion of them may seem unnecessary. Among the recent contributors to the subject is A. E. Halstead, who presents a most comprehensive study of sixty-nine cases which he has collected from the literature during the past ten years. The subject is a much more interesting one from the embryological and pathological than from the symptomatic and therapeutic point of view. Meckel's diverticula vary greatly in size and length and are capable of division into two classes: those which are free and those which have a fibrous extremity attaching them to the mesentery, the umbilicus, the abdominal wall, or to one of the abdominal viscera. The free variety is the onc less likely to give rise to serious abdominal inflammation or obstruction of the bowels, and yet cases are on record in which an unattached diverticulum has produced most marked pathological conditions. One can readily understand how such a diverticulum may easily make its way into a hernial sac, as reported by Webster, or how it may become impacted with feces, kinked or twisted upon itself, giving rise to either gangrene or the formation of a cyst, as reported by Taylor. Probably, however, the most frequent and serious lesion results from invagination of the diverticulum, which, of course, is not apt to take place when it is attached, and which usually produces a secondary intussusception of the small intestine. Numerous cases of this kind have been reported and probably no variety of intussusception is so difficult of reduction or so frequently requires intestinal resection. A recent case of this nature is reported by Dobson. Cases of perforated typhoid ulcer, situated in Meckel's diverticulum have also been reported, but must be looked upon simply as coincidences and not in any way due to the anomalous nature of the portion of bowel affected. Recently in operating upon a case of appendicitis I met with one of these unattached diverticula coming from the ileum, about two feet from the cæcum, of the same calibre as the bowel, and about one and a half inches long. Of course, the likelihood of trouble increases with the length of the diverticulum.

The attached diverticulum may be the seat of inflammation resulting in strangulation and gangrene, or it may produce any one of a number of forms of intestinal obstruction. It has been claimed by certain authorities that the condition is frequently associated with other malformations, such as hare-lip and club-foot, etc., but this has certainly not been borne out by recent collections of cases. Other malformation was found but once in Halstead's table of sixty-nine cases. As Meckel's diverticulum represents the vitelline duct extending from the primary intestinal canal to the umbilical vesicle, it is natural to expect to find the majority of the diverticula attached in the neighborhood of the umbilicus, and many authorities state that this is true. There is, however, some difference of opinion on this point, others claiming that mesenteric and abdominal wall attachments are more frequent. Briddon has reported a most interesting case of prolapse of the ileum through an unclosed diverticulum of Meckel in an infant one month of age. This case was operated upon and made an excellent recovery. Another case of diverticulum patent at the umbilicus is reported by Kammerer reports three cases of obstruction due to diverticula, and one is unique in that the sigmoid was the portion of bowel

The diagnosis of obstruction due to Meckel's diverticulum is next to impossible, although certain symptoms are looked upon as suggestive of the condition. The two most important of these are visible peristalsis and localized meteorism. In addition to these a history of previous attacks of partial obstruction is of value. Not only is the diagnosis difficult before the abdomen is opened, but in a number of cases reported the true condition was not discovered at the time of operation, but was found post-mortem. Of the acute inflammatory conditions of the abdomen with which strangulated and inflamed diverticula have been confused is acute appendicitis. This was true in the case I have just reported and was true in three cases reported by Erdman. Two of these cases recovered. Halstead found the mortality of the cases operated upon for obstruction was 68.1 per cent.—an exceedingly high mortality.

One can say little about the treatment, which, of course, consists in the removal of the diverticulum; but one point which I should like to emphasize is the fallacy of giving laxatives and purgatives for acute obstruction of the bowels, whatever the cause. It may seem unnecessary to make such a point, but you all know with what regularity these patients are given laxatives of all kinds and in all doses. The patients, if they are not to be operated upon, had best be given absolutely nothing by the mouth, and fed by the rectum. Laxatives but aggravate the condition and reduce the patient's chances of recovery. The only treatment is the removal of the mechanical cause of the obstruction.

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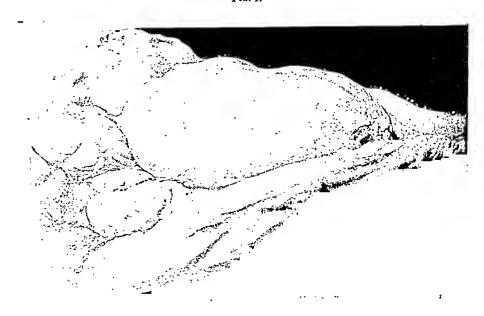
TWO CASES OF RETROPERITONEAL HERNIA.

By Louis J. MITCHELL, M.D., of CHICAGO.

WHILE, strictly speaking, there are four forms of retroperitoneal hernia, the cases herewith reported all belonged to that variety which occurs into the duodenal fossæ.

Case I.—Mrs. M. J., aged thirty years, colored, was shot through the heart, dying immediately. At the necropsy, on making the usual median incision and cutting through the abdominal wall, instead of





coming upon the omentum, or the intestines, a white, glistening sac (Fig. 1) was found, which seemed at first to be a mesenteric cyst or an ovarian tumor. After reflecting the abdominal walls and tracing

the relations, however, it was discovered to be a case of retroperitoneal hernia.

The mass, which measured 17.5 cm. by 27 cm., reminded one of the gravid uterus except that it was flattened in front. It was situated in the centre and left side of the abdomen, surrounded by the colon, extending below nearly to the promontory of the sacrum. The omentum, which was very thin and but slightly developed, was rolled up between the sac and the transverse colon. At the lower aspect of the sac on the right was an elliptical opening 5 cm. by 7.5 cm., from which 10 cm. of the lower part of the ileum escaped obliquely to join the cæcum. The remainder of the small intestine was contained within the sac.

The sac was smooth and shining; the walls thick, but translucent, so the intestinal coils could be discerned; the walls of the sac contained numerous bloodvessels, but little fat. The sac was free except on the left and above, and several folds ran off from its border and were lost in the surrounding peritoneum.



Fig. 2.

The orifice of the sac was situated low down close to the cæcum and looked forward and to the right (Fig. 2). The upper margin of this orifice was thick, fibrous, and opaque, becoming thinner below. The inferior mescuteric vein bordered the opening; the colica sinistra artery rau at some little distance from the free border. The vein was about the size of a goose-quill.

The coils of intestine in the sac were patent and moderately distended with gas, but were strongly adherent, so only part of them could be pulled out. The part that was mobile showed no changes in the mesen-

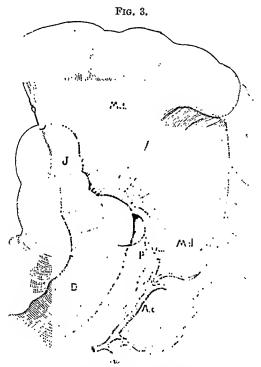
tery, or in the bowel itself.

As regards the large intestine, the cocum, ascending and transverse colons were in their proper places; the descending colon was in front of the sac, having been pushed forward; the rectum was normally situated. There was no congestion of the abdominal viscera or hemorrhoids.

Nothing abnormal was noted in the outward appearance of the abdomen. The walls were somewhat pendulous, but as strice were visible this may have been due to past pregnancies.

This is a well-marked example of the mesenteric hernia of Sir Astley Cooper, the retroperitoneal hernia of Treitz, and the duodenal hernia of Jonnesco, of which less than one hundred examples have been recorded since 1776.

At first considerable confusion arose from the cases being described as "preternatural pockets, peritoneal defects, anomalies," etc. This confusion continued until 1857, when by the publication of the classical



The duodeno-jejunal fossa. (Jonnesco, after Treitz.)

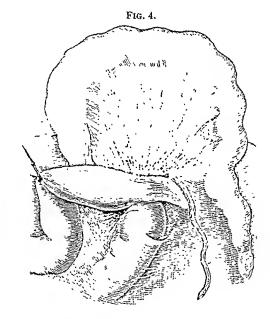
D, ascending duodenum. J, jejunum. P, duodeno-jejunal fold. V.m, inferior mesenteric vein. A.c., colica sinistra artery. M.t., M.d., transverse and descending mesocolons.

work of Treitz (Hernia Retroperitonealis) the condition was placed on a sound anatomical basis. Treitz met with eight cases between 1847 and 1854, and from a study of these, and of eighteen cases previously mentioned by other authors, came to the conclusion that the hernia is always formed in a fossa of the duodenal region, which he called fossa duodeno-jejunalis; that is, it is always acquired, and that it can become strangulated.

According to this author, three things are essential for the formation of this variety of hernia:

- 1. A dilatable excavation of the peritoneum.
- 2. A resisting ring.
- 3. A mobile intestine pressing against the ring.

The dilatable excavation of the peritoneum is, according to Treitz, furnished by the fossa duodeno-jejunalis. To see this fossa it is necessary to lift up the transverse colon and draw the small intestine to the right, when the duodeno-jejunal angle will be visible. When the fossa is present a membranous fold is seen passing from the anterior surface of the lower part of the duodenum to be inserted at a variable distance on the parietal peritoneum, thus forming a little pouch—the fossa duodeno-jejunalis, or inferior duodenal fossa (Fig. 3). The opening looks directly up and the fossa will usually accommodate the finger-



The inferior and superior duodenal fossæ. (Jonnesco.)

The inferior mesenteric vein at some distance from the inferior fossa, runs along the left border of the superior. Above is seen the transverse colon and mesocolon lifted up; on the left the descending colon, on the right the ascending duodenum, the two duodenal folds, and the fossæ which they limit. The jejunum is drawn to the right as well as the mesentery, under which the duodenum disappears.

tip to the second phalanx; sometimes it will hold two or even three fingers. The inferior mesenteric vein and the colica sinistra artery, as a rule, border the orifice on the left. Occasionally there is a superior fossa instead, which has the same relation except that the opening looks down, and sometimes the two fossæ are present at the same time (Fig. 4).

Opinions differ as to the frequency of occurrence of the fossa duodenojejunalis, thus: Waldeyer gives 70 per cent., Gruber 66 per cent., Treves 48 per cent., Debierre 50 to 75 per cent., and Jonnesco 75 per cent. for the inferior and 50 per cent. for the superior. The writer examined 1000 fresh adult bodies, with a view to ascertaining in how many it was present, with the following results:

Males.	Females.
Bodies examined 821	Bodies examined 179
Absent 513	Absent

308	78

The results are less than those quoted, but the fossa was carefully searched for and nothing counted as such unless it admitted the fingertip.

A resisting ring is furnished by the vascular arcade, composed, as before stated, of the inferior mesenteric vein and colica sinistra artery. This acts in the same manner as the inguinal and femoral rings for external hernias (Treitz).

A Mobile Intestine. According to Treitz, the increase of abdominal pressure so favorable for the production of external hernias has no effect on these forms, neither has dilatation by gas or food. Shaking of the body, on the contrary, especially if continuous and regular, as in walking, dancing, and riding, are prime factors, for in such cases the intestines press by their weight on neighboring viscera. When the hernias are of small volume the jejunum alone is involved, when of large dimensions the ileum is involved also. Complete hernias are found in adults and old persons; the incomplete in the young, as a rule.

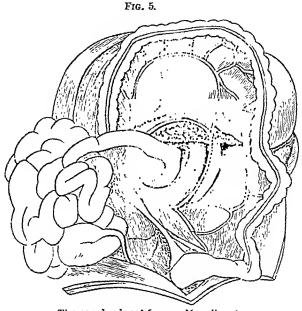
In a recent work, Mr. B. G. A. Moynihan, of Leeds, refers "to the exuberant and redundant nomenclature that has been adopted by the various writers at different periods. The term that has perhaps been, on the whole, most subjected to abuse is 'duodeno-jejunal.' It has been applied indiscriminately to every variety of fossa found in this region, to fossæ which are strictly duodenal, to fossæ which are jejunal, and to fossæ which are neither; but more and worse than this is the adoption by one author of a name suggested by an earlier writer for a fossa quite different from that which is being described. The result is chaotic." Mr. Moynihan then carefully describes no less than nine different fossæ in the duodeno-jejunal region, and gives his reasons for believing that the left variety of duodenal hernia arises in the paraduodenal fossa, or fossa of Landzert (Fig. 5).

This "is situated to the left, and some distance from the ascending

This "is situated to the left, and some distance from the ascending limb of the duodenum. The fossa is caused by the raising up of a fold, the plica venosa, by the inferior mesenteric vein—a fold which may not inaptly be described as a mesentery of that vein. Behind,

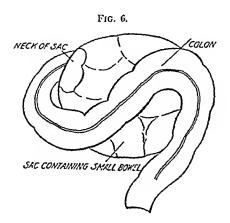
¹ On Retroperitoneal Hernia, London, 1899.

the sac is bounded by the parietal peritoneum, covering the psoas, the renal vessels, the ureter, and a portion of the left kidney. The orifice of the sac is wide, and looks down and to the right; the blind extremity is directed upward and slightly to the left. The width of the orifice



The paraduodenal fossa. (Moynihan.)

depends, of course, upon the distance between the inferior mesenteric vein and the duodeno-jejunal flexure—a distance which is capable of great variation" (Moynihan).



It seems to the writer that this opinion is well founded. If the inferior duodenal fossa (Treitz's fossa duodeno-jejunalis) were the seat, duodenal hernias should be much more common, since this inferior fossa is the most frequent of these peritoneal pouches.

In a conversation with the late Professor Wyatt Johnson, of Montreal, he stated that he had also met with a case of retroperitoneal hernia, and was good enough to send the following description and a rough sketch made at the time (Fig. 6).

Case II.—" In a little girl of four years, whose death was due to burns, at the post-mortem on opening the abdomen the peritoneum was smooth and shining, the vessels not injected. The small intestine was seen to lie in a separate peritoneal pouch behind the general peritoneal cavity. The opening of this was as large as the palm of the hand, with smooth, thickened edges, and was formed by part of the mesentery near the jejunum. The opening seemed to be the right side; the whole of the jejunum and ileum lay within this sac. The head of the cæcum and appendix lay outside it free and somewhat raised above the level of the right iliac fossa. The ascending colon passed over the point of the sac obliquely and to the left. The sigmoid flexure and rectum lay somewhat to the right of the median line at the brim of the pelvis."

In Leichtenstern's classical and frequently quoted article on intestinal obstruction, he states:

"Under favorable circumstances, if the hernia is of notable size, I consider it possible to make a probable diagnosis, not a positive one, but still one that is based on reasons. The circumscribed globular distention of the mesogastrium, with retraction of the region corresponding to the colon; the firm, elastic, spherical lump which can be distinctly felt when the abdominal wall is thin, giving the impression of a large, somewhat movable cyst, and extending from the mesogastrium principally to the left; the peculiarity that this well-defined tumor always yields a sonorous note on percussion, and clear intestinal sounds on auscultation; also the presence of hemorrhoids and the loss of blood from the rectum in consequence of compression of the inferior mesenteric vein, permit, when taken in connection with the subjective troubles indicating chronic disease of the abdominal organs, a probable diagnosis to be made. In case laparotomy is performed to relieve acute strangulation, profuse hemorrhage would be caused, when the hernial orifice was enlarged, by the division of the arteria colica sinistra and the vena mesenterica inferior, which latter is usually much dilated."

Moynihan points out that hemorrhage may be avoided by dividing the neck of the sac between two ligatures. So far only one case (Staudenmeyer's) has been diagnosed during life, but for some reason was not operated on.

The condition may be said to be a trouvaille of the dissecting table or the post-mortem room. Most of the cases have occurred in males. In some ten or twelve cases death was due to acute intestinal obstruc-

¹ Ziemssen's Cyclopædia of the Practice of Medicine, New York, 1876, vol. vii. p. 549.

tion. In many individuals the hernia seems to have had no effect on the duration of life; one subject was seventy-four, several others over sixty years of age. At the other extreme cases have been seen in infants of two weeks and two months, respectively. It does not appear to have yet been found to be congenital, though Moynihan claims there is no reason why it could not be.

Three cases have been successfully operated on (those of Sonnenburg, Tubby, and Neumann).

Further information may be found in Jonnesco's work, as well as the later and much less diffuse one of Moynihan, which has a good bibliography.

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SPLENIC ANÆMIA. A REPORT OF THREE CASES.

By J. A. Scott, M.D., Physician to the pennsylvania hospital, philadelphia.

During the past five years the medical journals of both England and America have contained several important articles upon the subject of splenic anæmia. Prominent among them are those of Sippey, Osler, A. H. Wentworth, Samuel West, J. S. Fowler, and J. L. Morse. The last four writers deal with the association of splenic enlargement and anæmia in infancy, and their observations have decidedly cleared the misty atmosphere that has hung around some of the diseases of childhood.

The American writers are in entire accord as to their main conclusions, based upon the observations of cited cases. A brief abstract of the conclusions arrived at follows:

¹ Hernies Internes Retroperitoneales, Paris, 1890.

- 1. There is no relationship between the anæmia and the enlargement of the spleen, liver, and the lymph glands. Cases with identical lesions of the spleen show varying degrees of anæmia and leucocytosis (Wentworth and Morse).
- 2. The blood shows a constant tendency to revert to the fetal type; the morphology of the red cells varies with the degree of anæmia, and not with the condition of the liver and the spleen. Normoblasts and megaloblasts are frequently found, with but little anæmia (Morse).
- 3. The leucocytes are frequently increased in number (regarding 14,000 as the normal), and usually correspond to the degree of anæmia (Fowler).

Morse thinks there is no relation between the reduction in reds and the degree of leucocytosis; thus, he finds a low red count with leucopenia, and a high red count with a decided leucocytosis.

- 4. The hæmoglobin index is always reduced.
- 5. Splenic anæmia and von Jaksch's disease are to be regarded as secondary anæmias.
- 6. The enlargement of the spleen, liver, and the lymph glands is not due to the change in the blood, but are all the result of a common cause—disturbance in nutrition.

There are, therefore, some points of difference in the symptom-complex as manifested in infants and adults:

- 1. The infrequency of hemorrhages from the mucous membranes in the former; its comparative frequency, especially from the stomach, in the latter.
- 2. The tendency of the splenic tumor to disappear under treatment in the infant; its persistence or gradual enlargement in the adult.
- 3. The presence of a leucocytosis in infancy; a leucopenia or a normal leucocyte in the adult. (Rarely a leucocytosis. Case I.)

There have also been not a few cases reported occurring in adults and children. S. M. Hamill, A. O. J. Kelly, P. L. Daniel, J. E. Talley, N. E. Brill, Bovaird, Geo. Peacocke, and A. L. Benedict, have all published cases showing the different types of splenic enlargement associated with definite anamia, so that we can more concisely define the disease under consideration. I can do no better than quote Dr. Osler's definition of anamia splenica chronica as given in his article in The American Journal of the Medical Sciences: A chronic affection, probably an intoxication of unknown origin, characterized by progressive enlargement of the spleen, which cannot be correlated with any known cause, as malaria, leukamia, syphilis, cirrhosis of the liver (primary splenomegaly); anamia of a secondary or chlorotic type (leucopenia); a marked tendency to hemorrhage, especially from the stomach, and in many cases a terminal stage with cirrhosis of the liver, jaundice, and ascites (Banti's disease)."

With the firm belief that cases of obscure disease can best be studied from the statistical standpoint, I desire to add to those already reported, the following cases of splenic anemia seen during the past several years.

Case I.*—J. C. H., aged thirty years; by occupation a ship steward and cook; admitted to the Pennsylvania Hospital (No. 3260) on January 7, 1903, complaining of a leg ulcer on the lower inner side of left leg. His father was a Canadian, with some admixture of Indian blood; mother, Irish. He was born near Chester, Pa., where he lived until he was seventeen years old. During his boyhood he had frequent attacks of chills and fever. Since 1885 he thinks his skin has been yellowish in hue, sometimes being more deeply so than at present. During and after the malarial attack in December, 1885, it was noted that his spleen was much enlarged, and it has so remained ever since.

To better his health he shipped on coasting steamers as a cabin boy from 1890 to 1893, and finally took to sea going vessels in 1893, and has since remained upon them in the capacity of a ship steward. In October, 1894, he had scurvy, "his muscles becoming soft and flabby and the teeth loose," and at that time there first developed an ulcer upon the left leg, which was slow in healing, and which has several times broken down since then. From December 12, 1895, to April 14, 1896, he was a patient in the Pennsylvania Hospital under the care of Dr. J. M. Da Costa (History, 1773). The splenic measurements were then identical with its present size. The blood count was, then: erythrocytes, 2,048,000; leucocytes, 12,000; hæmoglobin, 34 per cent. During his four months' stay in the hospital the blood count was but little changed, excepting an increased leucocytosis (20,000). No differential count was then made. One hyaline body (malarial) was reported to have been found, though subsequent examination failed to show para-The condition of the heart and the urine was identical with the present state. Upon his discharge from the hospital, a diagnosis of " malaria and splenic leukæmia" was made.

He states that he has had typhoid fever three times; the first attack in July, 1888, in Philadelphia, duration of two months, and under the care of Dr. J. M. Anders. The second and third attacks occurred in February, 1891, and July, 1892, in the marine ward of the German Hospital, duration of two to three months each. Pneumonia he has had twice: double pneumonia in the Bellevue Hospital, New York, in November, 1896, very ill for six weeks; again in 1899, at the Presbyterian Hospital, New York, under the care of Dr. Walter James, in hospital four weeks. He states that he has had malarial attacks (chills, with fever and sweats), during which malarial organisms were found in his blood in 1898, 1899, and in November, 1902. It is doubtful if these attacks have really been malaria. He has never had hemorrhages from the nose, stomach, or bowels. He is not an alcoholic, and he denies all forms of venereal disease. The digestion is usually

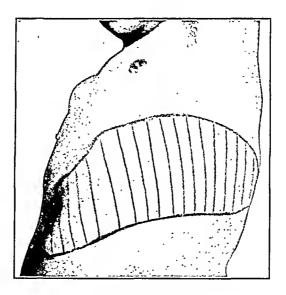
good, and bowels move daily.

Condition on Admission. He is a short, stocky man, with straight black hair and oval eyes, and a curious sallow skin with a distinct lemon tinge; in fact, he much resembles a Mongolian; there is no

^{*} This case was shown before the Medical Section, College of Physicians of Philadelphia, March 9, 1903.

unusual pigmentation on the face or body. He has several carious teeth, but the mouth is otherwise in good condition. When he stands erect the abdomen is protuberant. The chest is well formed; the lungs are normal. Heart: Apex in fifth interspace, just under the nipple. The outline of cardiac dulness is the right border of sternum, the third interspace to the midclavicular line. There is a soft, blowing, systolic murmur at the apex, transmitted slightly to the left. A murmur of the same quality is present at both aortic and pulmonary cartilages, and the second sound of each accentuated, the aortic, however, more so than the pulmonary. The liver dulness begins in the midclavicular line at the seventh rib. Its sharp, thin edge can be felt in the right parasternal line, several fingers' breadth below the costal margin. Its surface is smooth, and as it disappears under the left costal margin it is in close proximity with the spleen. The spleen is exceedingly large,

FIG. 1.



Chronic splenic anæmia. The outline represents the area of the spleen.

the upper border of dulness beginning in the seventh interspace in the midaxillary line. It extends downward and forward, crossing the median line above the umbilicus, its tip reaching to a point midway between the umbilicus and the right iliac crest. The lower edge curves away and downward, and lies within a finger's breadth of Poupart's ligament on the left, and almost rests upon the left anterior spine of the ilium. (See Fig. 1.) Its surface is hard and not nodular. The notch is felt on the anterior edge above the umbilicus; just above this point a small, soft nodule can be felt which seems to be attached to the abdominal wall. After some manipulation it can be displaced. It is probably a small ventral hernia filled with omentum. There is no ascites, no ædema of the legs; there is marked pigmentation on the right shin, which is of brown color. The leg ulcer is superficial with slightly raised edges, with bluish discoloration; the granulations are pale and sluggish. The urine is 1008, light in color, acid; contains a

trace of albumin, no sugar; on microscopic examination a large quan-

tity of uric acid with a few hyaline casts were found.

His blood was counted at intervals of every two weeks during his stay in the hospital. The first count was: erythrocytes, 2,440,000; leucocytes, 9050; Hb, 60 per cent. A differential count showed polynuclear, 54.4 per cent.; small lymphocytes, 36 per cent.; large lymphocytes, 1.6 per cent.; transitionals, 3.6 per cent.; eosinophiles, 4.4 per cent. Six normoblasts were found in counting 250 leucocytes. No malarial organisms were present on admission, or at any time subsequently. During his stay in the hospital the blood condition improved slightly, the erythrocytes rising to 3,208,000; the hæmoglobin to 58; leucocytes, 15,475; numerous normoblasts were found, and one megaloblast just before his discharge.

During February his vision, which was poor on admission, failed rapidly because of increasing opacity of the lens of the right eye, while the left eye also showed a beginning cataract. The examination of the fundus, made by Dr. George C. Harlan, showed no hemorrhages and was reported as normal. The temperature during his stay in the hospital was mainly subnormal, except upon two days, upon one occasion rising to 100.2° F. The leg ulcer, upon his discharge, March 31st, was almost healed, his main complaint being the loss of his eyesight, due to cataract formation. There was no evidence of hemorrhage from any

mucous membranes during his stay in the hospital.

Case II.—Rosie N., aged thirteen years; a school-girl; hospital No. 3079; admitted to Pennsylvania Hospital on December 23, 1902. Her parents are living, and the child has been in the United States but one month. She has been sick for two months, diagnosed as astivo-autumual malaria and treated with the hypodermic injection of quinine, without results. Her symptoms were headache, cough, and pain in the left side of abdomen. No fever present. It was stated that she passed blood from the bowel one week before admission.

On Admission. A well nourished girl, with pallid mucous membranes; moist, slightly coated tongue; the axillary, postcervical, and inguinal glands are slightly enlarged. The lungs are healthy, and the heart is normal in size, and the sounds clear. The liver is normal in outline, while the spleen is much enlarged (see Fig. 2), extending beneath the costal margin in the midclavicular line, and the tip reaches just below the umbilical level; the posterior border disappears beneath the costal cartilages in the midaxillary line. The surface is smooth and firm, edge sharp, and the organ freely movable. The extremities are normal. No unusual pigmentation.

The Blood. Erythrocytes, 31,120,005; leucocytes, 3600; Hb, 55 per cent. A differential count results as follows: polynuclear, 58.4 per cent.; small lymphocytes, 26.8 per cent.; large lymphocytes, 6.8 per cent.; transitional forms, 6 per cent.; and eosinophiles, 2 per

cent.

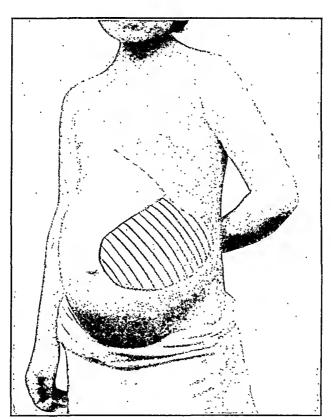
During her stay she passed a round worm and some undigested curds in the stools, while the temperature was irregular for two or three days. There were no hemorrhages from any source. There was decided improvement under increasing doses of Fowler's solution. The spleen was unchanged in size on her discharge, on January 24, 1903.

CASE III.—Charles L., aged thirty-two years; an Italian laborer; admitted to the Pennsylvania Hospital October, 1890; hospital No.

1954. He has been in America for two years. When fifteen years old had a malarial fever, and at twenty-two a continued fever for several weeks; these have been the only sicknesses. He complains of palpitation of the heart for five months, with some pain over the pubis and about the lower part of chest, and some loss in weight. He never had hemorrhage from any source, and no diarrhea; denies venereal disease.

On Admission. A large-framed, muscular Italian, with sallow skin and pale mucous membranes; the first molars and bicuspids in lower jaw are carious. The inguinal and axillary glands are decidedly and





Splenic anæmia. Duration of anæmia short. Outline shows the size of spleen below the costal margin.

the postcervical slightly enlarged. The chest is broad and deep, with normal breath sounds; the heart is slightly increased in its lateral diameter (11 cm.), with soft systolic murmur at the apex and both aortic and pulmonary areas (hæmic murmur). The liver normal in size, while the spleen is very much enlarged, the dulness beginning in midaxilla at seventh rib, and emerging beneath the costal cartilages in the midclavicular line, extends to the level of the umbilicus; it is hard and the notch can be felt. There is no ædema of the legs, and no pigmentation of the skin. An anæmia of chlorotic type is present; the erythrocytes are reduced to 2,084,000; the leucocytes, 4900; and

the Hb is 15 per cent. He remained in the wards until November 30th; during this interval the blood was counted six times, the results showing a rise in the erythrocytes to 3,360,000, and the Hb to 35 per ceut.; leucocytes, 4400. No nucleated reds were found; the differential count normal; slight poikilocytosis. The temperature was usually subnormal, though on one occasion it rose to 100° F., and at irregular inervals was 99° F. in the evening. The bowels were normal. treatment consisted in the administration of Blaud's mass, 5 to 15 grains t. i. d., and increasing doses of Fowler's solution. were malarial organisms found, and no definite cause for the anamia discovered. The spleen remained unchanged in size on his discharge.

The following case illustrates another aspect of splenic enlargement, and perhaps should be classified under the splenic anæmias, though the blood symptoms are wanting.

Case IV.—Varione F., aged thirty-five years; housewife; born in Italy. Previous health fairly good; has one child, aged eight years.



Primary splenomegaly. Enormous spleen, with no anæmia. Outline shows the

Scanty, but regular menstruation. For two years she has had slight pain in the abdomen, and noted its gradual enlargement. Occasionally

she has chilly sensations, followed by fever; admitted to Pennsylvania

Hospital January 8, 1903; hospital No. 3266.

On Admission. A well-nourished, healthy-looking woman, with clean, moist tongue; no evidence of anemia; the lungs and heart are normal; the lymphatics are not enlarged. The liver is of normal size, while the spleen is unusually large (see Fig. 3), extending to the median line, and as far as the iliac crest. It is smooth, firm, and slightly tender along the anterior edge; its transverse diameter below the costal margin is 16 cm. No ædema of extremities. No ascites. Menstruating at present, and has temperature of 99.4° F.

The Blood. Erythrocytes, 4,656,000; leucocytes, 4650; Hb, 80 per cent.; the differential count is practically normal; polynuclear, 75 per cent.; small lymphocytes, 11.66 per cent.; large lymphocytes, 8.33 per cent.; transitional forms, 3.33 per cent.; and eosinophiles, 1.66 per cent. The urine is 1018, and contains neither albumin nor sugar. A week later the red cells had risen to 51,440,005 and the Hb to 97 per cent. On account of the unusual motility of the spleen, I had a tight abdominal band applied, and we were not able to keep her in the ward after January 24th. In this case the splenic dulness began low—at the ninth rib—so that it is probable that the enlarged spleen was ptosed decidedly; the ability to move it about readily is also in favor of this view. I attributed her symptoms to the weight and mobility of the spleen, and, in the absence of any anæmia, considered the enlargement in part due to a kinking of the splenic vessels; this is the second case of such unusual enlargement of the spleen without anæmia I have seen in Italian women; in both cases the spleen was mistaken for a pelvic growth by the attending physicians and sent to hospital for operation. In one the actual diagnosis was not made until exploration of the abdomen showed the tip of the enormously enlarged spleen to be adherent to the left tube and ovary. The pathology of the specimen was a hyperplasia of the stroma; the splenic vein was swollen the size of the placental cord and much resembled it in appearance.

TREATMENT. Results of medicinal treatment in splenic anemia have not been satisfactory; measures to improve the anemia, the administration of iron and arsenic, with plenty of digestible nourishment and fresh air, are indicated. In some cases, especially in children, rapid improvement in the blood follows. In adults the enlargement of the spleen usually persists, and its size alone is a cause of considerable discomfort.

This has led to surgical interference and the removal of the spleen. Harris and Herzog¹⁴ have reported nineteen cases of splenectomy in splenic anemia, with fourteen recoveries. I have collected since their report six additional cases, with four recoveries (Warren, ¹⁵ Peacocke, ¹² Blanquique, ¹⁶ J. P. Bispham, ¹⁷ Cushing and Halstead.) ² The fatal result is usually due to hemorrhage.

REMARKS. None of the foregoing cases can be said to be typical, for, though all of them present a chlorotic anemia and an enlarged spleen, in but one of them has hemorrhage from the mucous membranes occurred (Case II.), and that before admission to hospital.

In two of the cases (II. and III.) the superficial lymphatics were somewhat enlarged, though in neither of them were there other signs of syphilis. In all the cases, including the last, malaria can be regarded as one of the factors in the splenic enlargement; three of the four cases are Italians, in whom splenic enlargement is an extremely common physical sign; three of them have distinct histories of so called malarial attacks. All the cases show a marked tendency toward chronicity, Case I. certainly having a history of at least eighteen years' duration. The first three cases, no other cause having been discovered for the symptoms, are therefore diagnosed as splenic anemia.

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SPONDYLITIS DEFORMANS.

By John Ruhräh, M.D., of Baltimobe, MD.

It has been my good fortune to have seen a number of cases of spondylitis deformans both here in America and in the hospitals abroad. I am convinced that the disease is more common than the text-books would have us believe, and that many cases are not diagnosed, through the fact that the physician has either no knowledge of the affection, or else only a very vague idea of what it is. For the purpose of calling attention to the disease, I report a case which came under my care last summer:

Clinical History. Patient is a white female, aged twenty-two years. Family History. Father, mother, and two brothers living and healthy. One brother died in infancy. There is no history of any special diseases in her ancestors.

Past History. Whooping-cough and chickenpox in early childhood. Diphtheria at the age of ten years. German measles about two years ago. At the age of fourteen years was thrown from a horse, striking on the right hip and shoulder. No bones were broken, and she recovered in about three weeks. About three years ago fell from a wagon, striking her face. She sustained no injury of any moment and recovered promptly. At the age of fifteen years she began to suffer with what was supposed to be rheumatism. The attacks of pain lasted from one to four weeks, and were worse in winter. The pain started in the right hip (the injured one) and then extended to the left hip, shoulders, and neck. Soon after her second fall, three years ago, her back became stiff. This she attributed to the fall. Since that time she has had pain more or less constantly in her back, shoulders, and hips, and especially in her neck. Menstruated at the age of thirteen years. This was regular for the first four years, but since then has menstruated every three or four weeks, and the flow has been irregular in quantity as well as time.

Present Condition. Back, neck, shoulders, and hips feel stiff and are slightly painful. The pain is usually on pressure or on movement. The region of the atlas and the axis are especially tender and painful. The entire spine is tender to the touch, but not markedly so. Experiences difficulty in lying down, as she has pain in almost every position. When lying on her back has pain along her spine; lying on her side the shoulders pain, and if on the right side the hip as well.

When she lies face downward the neck pains.

She is an average-sized girl, but is at present somewhat emaciated. The legs and arms are quite thin. About the neck and shoulders the atrophy of the muscles is most pronounced. The atrophy involves all the muscles about the shoulders and neck, with the possible exception of the trapezius. The deltoid is included. There is no fibrillation. The trapezius along the neck is thickened and hard, and seems to be filled with deposits resembling those of myositis ossificans. The muscles under the trapezius seem also to have similar deposits in them, giving the entire neck a hard, bony feel. None of the other muscles are affected in this way.

The spine is stiff and movements are practically impossible, although there is the very slightest amount of motion between some of the vertebræ. When sitting she cannot be bent forward, the spine being like one solid piece of bone. The head cannot be rotated, except very slightly to the right. Forward, backward, and sidewise movements

ean be made with the head, but they are very much restricted.

The shoulder-joints are both affected equally. The arms cannot be raised above the horizontal, and, unaided, not even that far. Below the horizontal the movements are fair, although restricted. On attempting to raise the arm above the level of the shoulder or in making any wide motions, she complains of pain, and a distinct grating can be felt.

The hip-joints are both affected, but the right somewhat more than the left. The legs can be extended fairly well and flexed to about a right angle. Abduction, adduction, and rotation are very much restricted. The movements within the limits of what she is able to make for herself are painless; any attempt at more extensive movements is ended with pain. She walks, usually with a cane, but she can get along unaided. Her steps are short, and progression slow and difficult.

There is no involvement even to the slightest degree of any of the other joints. For three weeks she was treated with massage, passive movements, and hot baths, together with the internal administration of arsenious acid. During that time there was no improvement at all, except as regards her general condition. She gained in weight, and her general appearance was much improved.

January 15, 1903. She remains well, except for the condition as

noted above, which is unchanged.

Nomenceature. The inflammatory conditions of the spine accompanied by ankylosis have not always been defined with sufficient clearness, and there exists, even now, considerable difference of opinion as to the exact nature of these affections. The truth, probably, is that there have been grouped together a number of affections differing somewhat as to their symptoms and greatly as to their cause.

In this country the coudition has received but scant attention. Goldthwait calls it "osteoarthritis of the spine" or "spondylitis deformans."

In Germany Strümpell described cases under the name of "chronic ankylosing inflammation of the spinal column and hip-joint" (Chronische anklosirende Entzündung der Wirbelsaüle und Hüftgelenke) and this name has also been used by Bäumler, Hoffa, Bregman, Hoffmann, and others, with the omission of the reference to the hip-joint; Köhler and Beneke call it "spondylitis deformans;" Oppenheim uses the term "arthritis deformans of the spine;" Beer names it "rigidity of the spinal column."

In France, Marie and others unite in calling it "spondylose rhizo-melique."

In Russia, von Bechterew, who has written extensively on the subject, calls it "ankylosing inflammation of the spine," and he describes what he thinks to be a separate affection under the name of "stiffness of the spine" (Steifigkeit der Wirbelsaüle). Popoff uses the term "neuropathic curvature of the spinal column."

In England the term "spondylitis deformans" is most generally used, while the name "osteitis deformans" has sometimes been improperly applied to it. This last name should, of course, be limited to the syndrome known as Paget's disease.

A somewhat analogous affection has also been described by Marie and Astie, under the name of "cyphose heredo-traumatique."

DEFINITION. Marie has defined the essentials of his disease as the coincidence of a complete fusion of the vertebræ, with a more or less complete ankylosis of the proximal articulations of the limbs, the small articulations remaining intact. If we are to accept his idea of the identity of this condition, the definition needs no elaboration. But there are, undoubtedly, cases where the spine alone is affected, and that but to a trifling extent. A similar process may affect other bones and

joints of the body, while the spine remains free; with this, of course, we have nothing to do in this paper.

HISTORICAL NOTE. It is no new condition. May examined the bones from Egyptian tombs known to be at least 5500 years old, and found one skeleton presenting the deformity of rheumatoid arthritis of the hands and other joints, while the spine, particularly the cervical region, was the site of marked changes. There existed a sort of fusion of some of the vertebræ. Other mummies from the same country, but of a much later date, exhibiting similar changes, have been described by Bland Sutton. Sturge, quoting an article in Virchow's Archiv, relates how Virchow off on a holiday trip found, in the charnel-house of a monastery, bones three or four hundred years old, which showed changes in the vertebræ. The same author, quoting from the work on rheumatoid arthritis by Dr. Adams, says that R. W. Smith described the post-mortem changes of a case before the Dublin Pathological Society in 1849.

Leyden quotes several cases, one described by Todd, where the disease was rheumatism, in which the entire spine was affected, together with all the other joints. He also mentions a case of Eulenberg's, in a girl of twelve years.

Lawrence, quoting Sandifort, states that there are in the museum at Leyden specimens showing ankylosis of the cervical vertebræ. Davies Colley mentions a specimen in the museum of Guy's Hospital. He suggests, as the cause of such changes, either rheumatism or gonorrhea.

Clutton gives the history of a case where the spine and proximal joints were affected, and also some of the smaller joints. There was a history of rheumatism. Fagge gives a very graphic account of a case of ankylosis of the spine, and describes the post-mortem findings. He called it a syntosis of the ribs and vertebræ.

The examples from the older writers, and the modern ones as well, might be multiplied, but would only show what I have already done, that the condition was described years ago. Bricon, I might add, has called attention to a similar affection in cats. In those animals affected there was complete fusion of the vertebræ. Sutton has described the disease in horses and oxen.

ETIOLOGY. There have been many ideas advanced as to the cause of the disease. Beneke has expressed the idea that rapid changes from heat to cold and vice versa play an important part in the causation. Blacksmiths, firemen, and the like are, however, subjected to such conditions and they do not seem to be more prone to the disease than others. Hoffmann reports a case in a man who had a severe acue of his back. On curing his acue the spinal symptoms recovered. He concluded that the cases were largely dependent upon a toxic basis.

Leri found that the phosphates and urates were diminished in the urine, and concluded that the disease is of obscure metabolic origin.

Fig. 1.



F13. 2.



Specimens of spondylitis deformans. From the Museum of the College of Physicians and Surgeons, Baltimore. Photographs by Mr. A. S. Murray.

The infectious diseases come in for their share of the blame. Marie, Raymond, Bäumler, and others think that gonorrhea plays an impor-

Fig. 3.



Fig. 4.



Specimens of spondylitis deformans. From the Museum of the College of Physicians and Surgeons, Baltimore. Photographs by Mr. A. S. Murray.

tant rôle; Hoffa reckons influenza as among the possible causes. Fagge reports a case where tuberculosis of the spine caused a similar ankylosis. Rheumatism has also been mentioned as a factor.

Von Bechterew would separate the cases into two classes as I have stated above, and regards the stiffness of the spine as secondary to nerve changes. Oppenheim is also an advocate of a nerve-origin theory.

Wilks lays stress on mechanical conditions and has described the lesions in laborer's spine.

As regards age, the cases are most frequently seen in young adults or middle age. Some cases have been reported in individuals of advanced age, and it has also been seen in children. Teixidor Sunol mentions a case at the age of thirteen years.

The majority of cases occur in men. Hoffa, Kirschgaesser, and others report cases in women. My own case was in a young woman.

From the above it will be seen that there are a number of causes that have been studied. The truth of the matter is very probably that any of the factors mentioned may be a cause of spondylitis. These differ very materially in their nature and will be considered more in detail later on.

Pathology. Two bone diseases may be considered. Goldthwait divides them into rheumatoid arthritis, where the inflammatory process is marked and is followed by ankylosis and atrophy of the bone, with marked deformity; and, secondly, osteoarthritis, where there are nodular deposits about the joints with no atrophy of the bones. The lesions found in the disease under consideration are the latter.

Marie very aptly described it as a fusion of the bones. Fagge graphically depicted the findings in his case in saying that the spine looked as if it had liquid bone poured upon it, and that this had been allowed to harden. Goldthwait has given admirable accounts of the post-mortem findings. The edges of the articular cartilages grow into nodules, which subsequently become ossified. The lesion extends into the ligaments that are inserted about the bone. In my case there were also nodules in the trapezius muscle that were separate from the mass about the spine, although lying directly over it. To quote Goldthwait: "With this hypertrophy at the edges of the cartilage, the centres and areas of pressure generally undergo atrophy. In the atrophy the interstitial tissue is the last to be absorbed; this, finally, does occur however, and the bones remain in apposition or become fused together. The process in the spine usually begins on one side anteriorly and extends up and down along the anterior lateral ligament. It may remain limited or it may extend to the whole spine."

The ribs are frequently involved in the process and the chest becomes immobile. In some cases there may be marked kyphosis with a consequent encroachment on the capacity of the chest. Tuberculosis may

be a secondary complication. The nodules may press on the nerves, nerve roots, or even on the cord itself. Later as the bone becomes older the symptoms of pressure on nerves or nerve roots may become better. Those from pressure on the cord itself do not improve.

CLINICAL HISTORY AND SYMPTOMS. The symptoms may be divided into early and into those after the disease has become fairly well marked. For the recognition of the early symptoms we are indebted to Goldthwait.

The symptom-complex is made up of four parts:

- 1. Pain.
- 2. Limitation of motion.
- 3. Muscular contractions.
- 4. Referred pains due to pressure on the nerve roots.

There are several types of pain met with in the early part of the disease.

There may be no pain in the site of the lesion, but referred pain is felt in the back, arms, or legs, according to the location of the lesion. It may be very severe and a cause of great distress.

There may be severe pain at the point where the spine is affected, and also referred pain in the back, in the anterior part of the spine, or in the back part of the abdomen.

In other cases it may suggest lumbago. It is worse after rest and improves after limbering up exercises.

Another type of pain is that referred to the anterior part of the spine, and of a very severe character. It may come on in paroxysms, and may be especially noted after periods of sleep. This type is most commonly met with when the disease affects the lumbar spine.

Referred pain is either unilateral or bilateral. When the latter, note that it is felt worse on one side than on the other. It is felt in the nerve endings, and not along the track of the nerve as in neuritis. There may be areas of hyperesthesia and anesthesia.

Associated with these pains there may be some limitation of motion, and this is usually worse on one side than the other.

There is no characteristic attitude in the early stages. There may be lateral curvature in the early case, and this may be more apparent on walking than on standing.

Later in the disease the symptom-complex is a striking one, so much so that Marie has insisted that it be regarded as a separate disease, not merely as a form of osteoarthritis.

The spine is as if the vertebræ had been soldered together. This may be complete, the entire vertebral column being as solid as one piece of bone, or it may be limited to some particular portion of the spine. When it is limited in extent it is most apt to be in the lower part, and involves the lumbar or the lumbar and lower dorsal vertebræ. The

cervical spine may in these cases remain unaffected for a long time. In other cases most of the ankylosis may be in the upper part of the spine.

Along with this stiffness of the spine there is a certain amount of deformity of it as well. There is a curving forward of the upper part of the back bone, and the patients usually maintain a stooping posture, which is rendered more pronounced on account of the ankylosis of the hips. The lower part of the spine remains more or less straight. The bending of the spine forward may occasionally be absent, and the patient may sit upright in what seems to be a most uncomfortably straight position. Scoliosis may also be present.

The exostoses can often be felt. This is especially true of the case where the cervical spine is involved as the nodules or bands of bone can be felt in the pharynx.

The abnormal deposits of bone may be so large as to be apparent to the most casual observer, as in the case reported where the neck felt like a large, solid mass of irregularly shaped bone.

The stiffening of the back is a slow process in most of the cases, and covers months and years, growing gradually worse and worse. The patients note the difference, especially by looking back at some previous date when they remember that they could move the spine to greater degree.

The ankylosis of the shoulder and hip-joints is a second marked feature of the disease. This comes on coincidently with the disease in the spine and gets gradually worse. The shoulders are affected to a lesser extent than the hips. The arm, however, in the average case cannot be raised above the horizontal, and will also be found to be limited in its motion in other directions if carefully tested. As a rule, the patient may think that his arm is perfectly good, because he has no occasion to make extensive movements. In women the change in the shoulder is noted early on account of difficulty experienced in dressing the hair, which soon becomes very difficult, if not impossible. Men whose occupation requires them to lift their hands above their heads, as clerks, notice the disease very early.

In moving the arm about and making wider movements than the patient can make for himself pain is caused, which in some cases is very severe. In many cases a rubbing or grating can be felt in the joint. The patient himself feels this, and it may be a cause of complaint. The grating may only be elicited by some particular movement, usually a forced one.

The hips are always affected to a greater extent than the shoulders. The involvement of the hip is always troublesome, interfering as it does with locomotion, station, and even sitting and the position in bed.

The patient soon gets so that walking is difficult, and then only to

be done when aided by a cane or crutches. When the ankylosis becomes pronounced the patient may be condemned either to bed or to a chair, but some of them manage to walk from the knees. This gives a most peculiar and characteristic gait. Sitting is not much interfered with in some cases, while in others, when the ankylosis is more or less complete, it may become so difficult that the patient remains bedridden. The position in bed is characteristic. If the patient lies on his back the knees are elevated in the bed, and if one attempts to straighten the legs forcibly so as to make them flat in the bed, the patient's back is raised. In the cases where there is more or less complete ankylosis of the spine, as well with the customary bowing forward of the upper part of it, the spine cannot be made to touch the bed all at once. On depressing the shoulders the sacrum is raised, and when the sacrum rests on the bed the cervical parts of the spine must be supported by pillows. The patient generally lies on the side with the legs drawn up.

In some cases the knees are slightly affected. There is limitation of motion and grating on forced movement. The patient is not at all disturbed by the knee involvement, and in many cases is ignorant of it until it is revealed by a careful examination.

Viewed from the side, the patients show a decided flattening of the chest and pelvis. In the former, evidently due to actual changes in the shape of the thorax, while in the latter it may be due to atrophy of the muscles, and possibly, also, to involvement of the bone.

There is also an atrophy of various muscles, due evidently in most cases to non-use, in some, possibly, to disturbance caused by pressure on the nerves. In some of the cases Bouchard's nodes have been described.

As the disease progresses pain usually ceases or becomes much better. The cause of this is probably in that during the acute process there is more or less vascularization of the soft parts, and the pressure on the nerve roots greater than later, when the active stage having ceased the tissues contract, and so the pressure is removed.

The ankylosis of the spine almost invariably involves the ribs, and causes fixation of part or of all of the thorax. In the cases where there has been an extensive involvement the thorax is fixed and the breathing wholly abdominal.

DIAGNOSIS. The diagnosis of the disease must be considered as regards the early cases and the late ones. The disease is unquestionably more common than has generally been supposed. It is not infrequent to meet with specimens in the dissecting-room of all grades of the disease. Most of the individuals have previously been under medical supervision in institutions, yet the disease rarely appears before medical societies or before classes. As Goldthwait suggests, many of the cases are passed over and treated as a "touch of rheumatism."

The early cases may be confused with beginning Pott's disease, and even some of the more advanced cases. In some it may not be possible to differentiate them until after several careful examinations made at sufficiently great intervals. The fact that the pains are greater on one side than the other is of some value. If there is paraplegia present, it may be differentiated, as the paralysis in Pott's disease is usually central, while in spondylitis it is of a peripheral type.

In his work on rheumatic gout Garrod states that there is usually some stiffness of the neck, and in 500 cases this was complained of 178 times. It is attended with some grating at movement. The presence of the other symptoms of the disease should serve to differentiate it. Nevertheless it should be borne in mind in considering pain in the spine.

Rheumatism may involve the spine. When it does, it generally is cervical, while spondylitis is usually in the lower part of the back. There are evidences of the disease in other joints, and the other symptoms. Von Leube states that according to his experience rheumatism of the spine is not a rare affection, and that it may occur without involvement of the other joints.

Pachymeningitis cervicalis hypertrophica may simulate spondylitis in the beginning. In this affection in the stage of irritation there are severe pains, stiffness of the neck, radiating pains, hyperæsthesia and anæsthesia in the arms, exanthems, herpes, and pemphigus, as well as scaling and roughness of the skin of the arms, and rarely twitching of the muscles. There may be difference of the pupil.

Pachymeningitis hemorrhagica interna is accompanied by stiffness of the neck and radiating pains. It gets better and worse, and is associated with mental and brain conditions. It usually occurs in drunkards and syphilities and cannot, as a rule, be diagnosed.

Traumatic hereditary kyphosis (cyphose heredotraumatique) has been described by Marie and Astie. In this affection there are the etiological features of heredity and trauma. The entire spine is involved in a large curve, while the joints of the members remain unaffected. There are nerve pains, particularly of the sciatic.

Laborer's spine, the duplicature champêtre of the French, must not be confused with spondylitis. It is common in those whose occupation involves almost constant stooping. In this condition there are no exostoses, and but trifling involvement of the joints, according to Marie. Wilks, as stated before, described osteoarthritis as laborer's spine.

Gonorrhea involving the spine should also be considered, not only as a possible etiological factor, but in view of the fact that it has been described as involving the spinal articulations. Noten mentions two cases. One recovered, and one passed out of sight. Other joints are apt to be affected. It is evidently of extreme rarity. Out of 119 cases of gonorrheal rheumatism cited in the Dictionnaire de Médecine et

Chirurgie (quoted by Bradford and Lovett) the spine is not mentioned at all.

Von Bechterew's symptom-complex is based on his own cases. It consists of:

- 1. A greater or less immobility of the entire spine or a part of it, with no marked pain on pressure or percussion.
- 2. A backward bowing of the spine, especially of the chest region, causing the head to be thrown forward and the chin depressed.
- 3. A weakened condition of the muscles of the rump, neck, and extremities, often with a trifling atrophy of the back and shoulder-blade muscles.
- 4. A lowering of sensibility, particularly of the skin branches of the dorsal and cervical nerves, and sometimes of the lumbar nerves.
- 5. Various irritation phenomena, as paræsthesia, pain in the back and neck regions, especially in the cases of long standing.

Von Bechtercw has described cases of spondylitis as well as cases of the above syndrome, and insists on the identity of his disease, regarding it as one of nervous origin. There is an ascending degeneration of the cord in these cases and there are no exostoses.

In passing it might be said that Folli has described an atrophy of the anterior cornua in a case of spondylitis. The cord has not been studied in many cases of spondylitis.

It must be borne in mind that stiffness of the spine is a symptom of no inconsiderable moment in many conditions, especially those of nervous origin, although it is a much neglected onc.

The diagnosis is, as a rule, easy, but it might be well to mention the conditions in which it occurs.

According to Bäumlein it is a constant feature of hereditary ataxia, and he places the cause of it in this condition, as do Hallion and Friedreich, as an insufficient musculature.

In syringomyelia it is also a feature of moment; indeed, there is considerable danger of mistaking some cases of syringomyelia for spondylitis, if the former disease is not borne in mind. The stiffness of the spine, with limited active and passive motion, may be misinterpreted by a careless observer. Roth states the cause here is due to changes in the muscle, but Schlesinger, Brühl, and Hallion regard it as due to trophic changes in the bones. Nalbandoff has recently ascribed the changes to the same causes, after careful study.

Kyphoscoliosis is seen, too, in infantile hemiplegias and diplegias (Oppenheim), in the acute infantile anterior poliomyelitis, in amyotrophic lateral sclerosis; in tabes it may be seen as a spinal arthropathy; Charcot subsequently, in 1886, called attention to the same deformity in sciatica; in the interstitial hypertrophic neuritis of Sottas and Dejerine, scoliosis is constant.

Duchenne has called attention to an hysterical scoliosis, but Albert, of Vienna, states that it is of very rare occurrence.

The stiffness of the spine in paralysis agitans must not be forgotten.

Lastly, Oppenheim gives it as a neuropathic tare, which coincides with the experience of most physicians.

Prognosis. With an early diagnosis and proper treatment the prognosis, according to Goldthwait, is better than formerly supposed. Much of the deformity can be prevented. Otherwise the prognosis must always be guarded. The danger to life itself is trifling. No deaths from the disease have ever been reported. It may be indirectly the cause of death in that those patients with ankylosis of the ribs may contract tuberculosis owing to the deformity and immobility of the chest.

Pressure on the nerves may cause pain which is difficult to relieve.

The disease may progress slowly and produce a great amount of deformity or it may stop short at any time. In many cases the disease is not recognized during life, but is revealed at the post-mortem or may be found in the dissecting-room.

In many cases the disease undoubtedly causes but little disturbance. In others it may produce total disability. There is at present no way to tell which case will do well, and which badly.

TREATMENT. The general condition should receive attention. All of the smaller ailments of the patient should, if possible, be cured. All sources of possible absorption of toxic material should be removed. The skin should receive careful attention, and warm baths and massage may be used for this purpose, as well as to aid in the general building up of the patient. Electricity will also be found useful.

The tendency to constipation should be corrected. Phosphate of soda and similar drugs are of value in this connection.

Good, nutritious food, plenty of fresh air, together with such tonics as iron, cod liver oil, arsenic, strychnine, and alcohol, as may be suited to the case, are to be advised.

Individuals with a rheumatic tendency may be given salol or the salicylates, but long courses of treatment with these or other drugs which tend to deplete the system or to cause anxemia are to be avoided.

In the early cases much can be done, according to Goldthwait, to relieve the symptoms and to prevent the deformity. He recommends the use of mechanical support to the spine either by the use of plaster casts or of special apparatus. He claims to have gotten excellent results by these means. The support is to be kept until the disease is entirely quiescent.

Bäumler obtained good results in one case by placing the patient in bed on his back. This same end may more easily be accomplished with the use of supports to the spine.

Local warmth is especially agreeable to these patients, and a thick layer of cotton may be applied next to the skin.

In the older cases where the disease has already caused deformity the results of treatment are on the whole not very satisfactory.

Forced movements, extension or suspension, are not to be used, as they bring a strain on a diseased part, and consequently do more harm than good.

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A CASE OF OSTEITIS DEFORMANS, WITH HEART COMPLICATION.

By Charles J. Foote, M.D., of New Haven, conn.

THE following case of osteitis deformans is reported because of its unusual visceral complications:

B. W. P., aged fifty-two years, bachelor, American; oysterman. Entered the New Haven Hospital February 11, 1893.

Mother died of consumption at fifty-seven years of age; father died

at eighty-five years of age. No record of brothers and sisters.

Patient had scarlet fever in childhood, and there Previous History. has been some deafness with more or less discharge from the ears ever since. With this exception he has been well, and gives no history of rheumatism, gout, syphilis, or other disease. About twenty years ago he was much addicted to the use of alcohol, but for the past nine years has been quite temperate. He gives a history of trouble with his legs in 1885, resulting in ulcers which did not heal for some years. In January of 1893 patient began to be troubled with severe dyspnæa and was confined to his bed. He entered the hospital February 11, 1893. At that time the following record was made of his condition: Veins of neck and forehead excessively distended and pulsating. Face and hands cyanosed and cold; considerable ædema of legs and some ascites; legs below knees are enormously swollen, discolored, and covered with a thick, dry skin resembling that of elephantiasis; one small ulcer yet unhealed on shin-bone.

Examination of Lungs. Negative.

Apex-beat in fifth interspace inside nipple line. The beats are rapid, irregular, and tumultuous. The area of heart dulness somewhat increased. There is a very marked murmur preceding and taking the place of the first sound, heard loudest at apex, but also to a less degree in the aortic and pulmonic interspaces. There is a great venous engorgement; a bruit may be heard over a large, pulsating, venous tumor over right sternoclavicular articulation. Heart sounds may be heard all over the neck and chest. Liver dulness begins above at the sixth interspace and extends just below the free border of the ribs in the nipple line. Liver easily felt on palpation.

Spleen not apparently enlarged.

Urine. Specific gravity 1020; amount varies from 800 to 1000 c.c.;

a trace of albumin, no casts.

I first saw the patient on August 20, 1893. At that time the heart was considerably enlarged. The left line of dulness was fully one inch outside the nipple line. The apex-beat was in the fourth interspace just outside the nipple line. Systolic murmur at apex transmitted to the axilla; second pulmonic sound much accentuated, with slight reduplication over pulmonic area.

Liver extends one inch beyond border of the ribs in the parasternal

There was considerable ascites.

From this time to July, 1895, the patient was tapped frequently, at times every six weeks; at each tapping from three to five gallons of serous fluid were removed. After July, 1895, there was no ascites to the time of death, November 26, 1898, and the abdominal walls were lax and sunken.

For the last three years of the patient's life, therefore, there was an excellent opportunity to palpate the abdomen. The spleen, liver, and kidneys could be easily felt and manipulated. The lower border of the liver, in fact, could easily be seen ascending and descending with respiration. During the last three years of the patient's illness there was a gradual increase in the size of the liver. The year of his death it extended two inches below the border of the ribs in the nipple line, and the outline of the lower border could be plainly seen. was not especially tender; it was smooth and not nouldar; there was no very marked enlargement of the veins of the abdominal walls. On palpation the liver was felt to pulsate; the pulsation was systolic in tone and may have been due to the transmission of the ventricular impulse of the enlarged heart. There was no history of jaundice.

The enlargement of this organ was discovered in 1896. As in the liver, there was a gradual enlargement. The year of the patient's death it extended about one inch below the border of the

ribs and could be easily palpated.

The heart gradually enlarged each year. The year of his death the left line dulness was one and one-half inches outside the nipple. systolic murmur was heard loudest over the second left interspace, apparently the same murmur, but much weaker, heard over the second right interspace. As we went down toward the apex it grew weaker and was heard very faintly at the apex.

Patient died November 26, 1898, five years after entrance into the hospital, at the age of fifty-seven years. No autopsy.

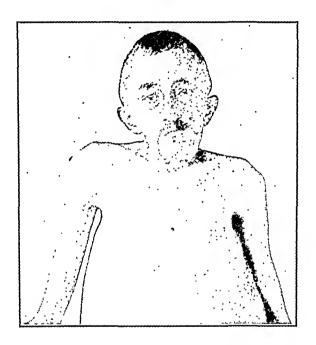
When examining the patient I was frequently impressed with the size of his head and the massiveness of his tibiæ. This led me to a diagnosis of osteitis deformans, and to make a more careful study of the bones.

The head was large, as a whole, the enlargement involving mostly

the calvarium, while the face was rather small.

The face had a triangular shape, with pointed chin and rather broad forehead. The circumference of the head at the line of the hat band was 25½ inches. Patient said his head had grown large during the last twenty years; he used to wear a 7½ hat, but now wears an 8½. The surface of calvarium is irregular. On each side of the sagittal suture there is a very pronounced depression in each parietal bone measuring 5 x 6 cm., giving the impression of a collapse of the skull.

Fig. 1.



The angle of the jaw is very oblique, in fact, almost obliterated, so that it seems like a straight line from condyles to the chin. The mas-

toid processes are very prominent.

There are only a few teeth left in the upper and lower jaws. The gums are much retracted from the teeth that are present, and the teeth are loose and decayed. The maxillary process on both the upper and lower jaws seems atrophied. The zygomatic processes are not especially prominent.

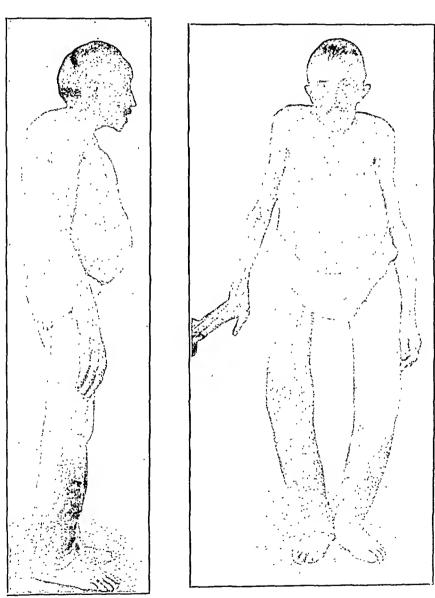
The spine shows a very marked kyphosis in the dorsal region. The seventh cervical vertebra is very prominent, but none of the other vertebra are. There is no lordosis. The dorsal curvature produces a decided shortening of the stature. The head is characteristically

projected forward, as shown in the photograph. (Fig. 2.)

The chest is decidedly barrel-shaped; the anteroposterior diameter being as long, if not longer, than the transverse diameter.

The shape of the elest is well shown in the photograph, lateral view. It bulges much behind in the upper dorsal region. In front there is a decided depression in the sternum just below the articulation of the elavieles; below this point there is a bulging forward of the elest.

Fig. 2. Fig. 3.



The ribs are very prominent and rather massive in the axillary regions; the seventh rib especially seems much enlarged, so as almost to obliterate the intercostal spaces at this point.

The elavieles are very large and prominent, especially at the acromial

ends.

There is a certain amount of eversion or spreading of the borders of

the ribs above the right and left hypochondria, which is characteristic of the disease; but in this case was quite likely caused by the enlargement of the liver and the ascites.

Examination of the upper extremities shows some enlargement of the spines of the scapulæ, especially at the acromial ends. The humerus seems normal. There is a decided bowing outward of the radius on each side, with a marked prominence of the styloid processes of the ulnæ.

The bones of the hands are not enlarged.

The pelvis is broad; the distance between the crests of the ilia is 34 cm.; the conjugate is 21 cm. No local irregularities noted about the femora or patellæ, but there is a decided bowing outward of the femora.

The tibiæ are very large; in fact, these were what first suggested the diagnosis of osteitis deformans to me. The tuberosities especially seem much enlarged.

When the patient is standing erect, with heels together, he cannot

approximate his patellæ within 30 cm. of each other.

The feet show no bony enlargements.

This case is interesting not only on account of the bone lesions, but on account of the affection of the liver, heart, and spleen. In osteitis deformans these organs are not necessarily affected; in fact, the viscera are usually normal.

The patient entered the hospital for dyspnœa and cough. Diuretin was given him and it seemed very efficient in relieving his ascites

and ædema and increasing the amount of urine.

During the last three years of the patient's life he was quite comfortable most of the time, and was up and around the ward in a wheel chair nearly every day. He had a fair appetite and suffered little pain anywhere, though at times he had diarrhæa lasting for a few days. He was extremely weak on his legs and walked but little. He died more as a result of the heart lesion and its sequelæ than of osteitis deformans. There was no evidence of sarcoma in any part of the body.

A CASE OF ANEURISM OF THE INNOMINATE ARTERY; LIGATION OF THE RIGHT COMMON CAROTID AND SUBCLAVIAN ARTERIES, FOLLOWED BY SECONDARY HEMORRHAGE AND DEATH.

BY JOHN G. SHELDON, M.D., SURGEON IN CHARGE OF THE MINERS' UNION HOSPITAL, TELLURIDE, COLORADO.

JOHN J., aged forty-one years, laborer, came to me in November, 1902, complaining of a pulsating growth on the right side of the neck, pain in the right side of the chest, right shoulder, and right arm, and severe headaches. He knew of no cause for his trouble. He had been well until six months previous to seeing me. At that time he accidentally noticed the tumor, which had progressively increased in size.

The patient denied having had syphilis. Had used alcohol and tobacco moderately. His father died of apoplexy at the age of fifty-

seven years.

Examination revealed a pulsating tumor behind the right sternoclavicular articulation, which extended one inch above the clavicle. Dilated veins were present over the anterior surface of the chest and neck. The region corresponding to the location of the innominate artery was more prominent than was the corresponding area ou the left side, but no pulsation of the thorax could be detected. Palpatiou revealed a thrill over the innominate artery. A bruit could be heard distinctly. The radial and carotid pulses were slightly retarded on the right side. The radial arteries were tortuous and hardened. The pulse was full and the arterial pressure high. The heart was slightly enlarged to the left, and was beating regularly eighty times a minute.

A diagnosis of aneurism of the innominate artery was made. Ligation of the right common carotid and subclavian arteries, followed by filipuncture and electrolysis of the aneurism and the administration of

potassium iodide internally, was advised.

The patient was anæsthetized with chloroform, and two catgut ligatures placed on the common carotid about one inch above the ancurism. A single catgut ligature was placed on the third portion of the right subclavian artery. After the operation the arm was kept moistened with warm saline solution. The entire right upper extremity became painful and helpless, but the circulation was sufficient to retain its vitality. The pulsation in the tumor was not affected by the operation.

On account of the severe pain the patient desired that further operative procedures be delayed for a few days. His request was granted. On the third day following the operation eight ounces of a 2 per cent. solution of gelatin were injected into the left axilla. This produced no noticeable effect. On the fifth night following the operation the wound over the carotid opened and bled freely for a few minutes. A compress stopped the bleeding. During the next day four hemorrhages occurred. The following uight the patient had nine hemorrhages; some of them were severe.

The patient was becoming weak, and a ligation of the innominate was decided upon as a last resort. During anæsthetization the patient coughed once violently. Immediately a large quantity of blood escaped from the incision over the carotid. The wound was packed firmly, but the patient became pulseless and died.

Post-mortem examination showed a fusiform aneurism of the innominate artery three inches in its transverse diameter. The rupture had occurred at the upper and posterior part, filling the mediastinum and surrounding structures with blood. A complete autopsy was not made.

When this case came to me I was undecided as to the course of treatment to advise, and I am still at sea on the matter.

The results from ligation of the innominate are such that the operation is an undesirable one. Ligation of the internal carotid and subclavian does not give eucouraging results. A case similar to the one herewith described was reported from Braun's cliuic at Königsberg. The patient showed no improvement after ligation of the carotid and subclaviau, and died fifty-one days after being operated upon. H. Jacobsthal (Centralblatt für Chirurgie, August 23, 1902) believes that peripheral ligation is more likely to increase the blood pressure than

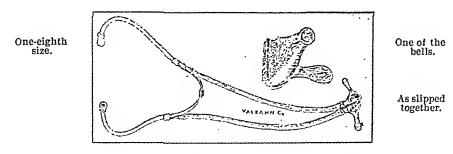
to lower the pressure or slow the stream. He states that the results recorded do not support ligation. He found no improvement in any of his cases treated by this method. In 1893 Pivot reported ninety-three cases in which peripheral ligation was done, with 7.4 per cent. of cures. Jacobsthal reported thirty-three cases treated by Macewen's needling, potassium iodide, filipuncture, and subcutaneous injections of gelatin. Fifteen of these cases were improved. One lived three and one-half years, death resulting from cerebral softening. The autopsy showed the aneurism completely thrombosed.

AN IMPROVED FORM OF STETHOSCOPE.

BY HENRY E. WETHERILL, M.D., of PHILADELPHIA.

This instrument does better what other stethoscopes do, and in addition has other functions not common with instruments of its class. With it you can auscultate two parts at once, and get an intimate comparison of the sounds. The comparison of the vocal fremiti from different locations can be delicately made.

A more intimate comparison of sounds can be had than is ordinarily obtained, by first listening to one sound and then to another. A little practice enables one to differentiate two sounds occurring at the same time.



When one sound is made a little before another their comparison is more intimate than when a considerable time elapses between the making of one sound and the making of another. Thus, when the little taps are made on the projections of the bells, the sounds coming from the part percussed are intimately differentiated. Slight asynchronism of sounds is detectable, as where there may be a difference in time of closure of cardiac valves. Transmitted murmurs can be timed with valve closures. Where a closer isolation of a valve sound is wanted, one of the bells is used and gives plenty of sound, and is so constructed that it will fit well in spaces, as between the ribs.

Percussion can be made with but one bell or with both. For superficial auscultation the rubbing of the finger over the slightly roughened end of the flexible projection will give a note depending upon the dulness or resonance of the body underneath. The very soft copper projections are positioned so that the thickening at their extremities will come under the second fingers, and their flexibility enables one to adjust the metal to the part so there will be no air space or false motion, and a good note will be produced. The fingers striking the projections equally enable us to compare the notes that are transmitted by the tubes to the ears. Separated from the tubes, the bells can be used as single or double pleximeters. The fingers act as plexors.

Auscultatory percussion can be done with one bell and tube, or with both, or one or the other bell may be used for auscultation or percussion in auscultatory percussion.

The instrument is good where one little sound is to be compared with another. The larger sounds are easier to compare.

The increase of vocal fremitus at the right apex is very nicely shown by placing one bell on either apex, and having the patient say, "one, two, three," or "hum-m-m."

Immediately the greater succussion and noise will be feebly heard in the ear connected with the part giving the greatest vocal fremitus. In this way the instrument is useful in detecting the first stages of phthisis pulmonalis. This is one of the best points about this instrument, and renders it of incalculable value as an aid to early diagnosis when the physical signs are obscure.

If there is a difference in one's ears it can be allowed for by testing, as by listening to the sound of a clock, using both bells. In practice the changing of the position of the bells will serve to eliminate this objection.

The comparison of remote parts can be made, and even one person can be compared with another.

Where one bell is used the oval lumen of the other similarly shaped bell may be closed with the thumb, which fits it, or the trouble with extraneous sounds may be entirely avoided by having the room quiet.

The parabolical shape of the bells, the nature of the metal, the large sizes of the tubes, and the general ensemble of the apparatus is conductive of clear sharp notes of considerable loudness, which compare to advantage with various forms of phonendoscopes.

A diaphragm may be put on the end of the bells, but it is not necessary, and the greater simplicity of the apparatus is an advantage. It will stand rough usage.

The projections can be repeatedly bent near to the sides of the bells when they are not being used.

The hinging of the springs holding the ivory-capped metal tubes in

the ears helps their adjustment to the lumen of the auditory canals, as well as making the folded instrument compact for the pocket.

The beating of the heart can be heard through the clothing, and the bells can be slipped under the collar and clothing.

The bevel dovetail joint fastening the two bells is held firmly together by the binding of the metal and the rubber, so there are no extraneous sounds from false motion between the bells. Thus joined a single stethoscope is made.

In locating the limiting line of an area of dulness, resonance, etc., the bells can be moved past each other, and when the sounds reverse in the ears the opposite condition is under the bell used. When the sounds are the same in both ears the conditions are similar. The bells can be moved about to localize such areas of dulness as are present in catarrhal pneumonia; and in the same way one lobe of the lung can be outlined when it is pneumonic.

Areas of dulness can be compared with one another, and the bronchial breathing on one side can be compared with normal respiration on the other.

In using one bell as a pleximeter it is grasped with the thumb and first finger, and the second finger is used to strike the thick end of the projection, thus acting as the plexor. Thus, but one hand is used where we formerly used two, and the blow has good quality and can ordinarily be struck with sufficient force, particularly when the tubes are attached. The bell can be held in one hand and the end of the projection struck with the second finger of the other hand when a wrist or arm force is desired. Very little practice is required to be able to strike similarly with either second finger. One can use this method of percussion in awkward positions, and a very sick patient need not be disturbed; and where a spot is tender light percussion with the aid of the auditory attachment will bring the condition to the ear without unnecessary pain caused by a heavier percussion.

Percussing with both bells is like using four hands, for ordinarily we use two for one percussion. Doing as above enables us to intimately compare two sounds, and, in case we are a little unfamiliar in separating two sounds struck at the same time, one percussion can be made a little before the other, and in this way a close comparison of one with the other can be made. As pleximeters one bell may be used in either hand independent of the detachable tubes.

It is more a comparison of two sounds that we want in medicine than it is to have a comparison with sound standards, which are difficult to get.

Where we tapped and listened, and then tapped the other place and listened, and then compared the dying-out sound with the mental picture of the first sound made, there was room for a considerable personal equation. Doubting ourselves many times, or forgetting the first sound, we have returned to make the first sound again and again. This is obviated by the present instrument.

In making this stethoscope it is believed that new matter of value has been added in this line, as the acoustics of the subject have been considered; and where new functions are added to the stethoscope they seem to be of advantage, as shown by the trials of the instrument by quite a number of my colleagues. The instrument has been improved upon repeatedly during the considerable length of time in which it has been tested.

For want of a better name, I call it a "Double, or Differential Stethoscope."

THE FERMENTATION THEORY OF INFECTION AND IMMUNITY.

By J. W. McLaughlin, M.D., professor of medicine, school of medicine, university of texas.

In 1828, when Wöhler synthetized urea, modern physiological chemistry was born, and at the same time it was demonstrated beyond a peradventure that the peculiarities of organic substances are the result solely of the properties of carbon, their chief constituent. From that day until this it has been more and more clearly demonstrated that the so-called vital processes are but highly specialized chemical and physical phenomena such as are daily encountered in our laboratories. The recent work of Loeb, which carries into the realm of physiology the work of Van Hoff, Arrhenius, and others, is a gigantic stride in the demonstration initiated by Wöhler. That the phenomena of fermentation and of infection and immunity are strictly analogous processes and that these analogies point unerringly to a common causation has been recognized for more than three hundred years; yet the common cause has heretofore remained a mystery. It is the purpose of this essay to present an explanation of those phenomena based upon accepted theories of molecular structure and molecular energy.1

Fermentation, broadly speaking, is a chemical or chemicophysical change induced in certain substances by specific bodies themselves unchanged and resulting in specific products. These change-inducing

¹ The principles of molecular physics involved in the explanation of fermentation by the author were utilized by him as far back as the 80's to explain the mysterious action of medicines on the living organism; and in 1890, in an abstract of a paper on fermentation, immunity, and infection, read at the annual meeting of the American Medical Association, these same principles were held to underlie the phenomena of these processes. In 1892 this subject was more fully elaborated in a small volume, which was published by the author, entitled "Fermentation, Infection, and Immunity."

bodies may be divided into (a) living ferments and (b) non-living enzymes. In a narrower sense the term "fermentation" is applied merely to changes induced by living ferments; while the term zymolysis or zymosis is reserved for that produced by enzymes. Living ferments are micro-organisms, which are widely distributed in nature, including many bacteria, blastomycetes, and some moulds. Enzymes or non-living ferments are bodies which are formed within living cells of animals or plants of the higher order of life. The two classes of ferments present many points of similarity in their action; for example, both classes work best at practically the same temperature, about that of the normal human body; both are destroyed by boiling; either will cause inscluble substances to be transformed so that they pass into solution; each is hindered and may be arrested in its action by the products of its own activity; neither adds anything from its own substance to the ferment products; and each manifests selectivity, in that a definite structural relation must exist between the ferment and the fermentable substances, in order that fermentation or zymolysis may take place. "We know that properties which are supposedly characteristic of the enzymes are possessed also by certain elements which are found only in the inorganic world. The most notable property of the enzymes is their ability to effect an amount of change which is out of all proportion to the quantity of the enzyme present, and the fact that the enzyme itself apparently does not enter into the reaction. These properties, however, are common to certain metals and their oxides. Bredding and von Bermaik showed that a gram-atomic weight (193 grams) of colloidal platinum diffused through 70,000,000 litres of water shows a perceptible reaction, or more than 1.000,000 times the quantity of hydrogen peroxide; and H. C. Jones demonstrated that the reduction that here takes place is a monomolecular reaction. Curiously enough, the analogy between the action of such metallic solutions and that of the enzyme goes farther. Finely divided platinum, palladium, iridium, osminm, etc., thus have the power of inverting cane-sugar, like one of the enzymes-invertase; and certain poisons, such as hydrocyanic acid, sulphuretted hydrogen, carbon disulphide, and mercuric chloride, which inhibit or even suspend the action of the enzymes entirely, exert a similar influence upon the solution of colloidal platinum."

It was shown by Pastenr, and later confirmed and more fully worked out by Hansen, that a pure culture of ferment micro-organism is necessary in order to secure purity in sacchariferous fermentations. The quality of beer, for example, has been greatly improved by methods in securing pure cultures of the required ferment. More recently Emil Fischer has, by purely chemical research resulting in his cele-

brated work on the synthesis of sugars, on the usc of phenylhydrazin, and on the ozone reaction, diverted the current of views on fermentation phenomena into new channels. His researches led him to explain the behavior of yeast toward the particular sugar of the nutritive liquid in the same way as the action of the enzyme (invertase, emulsin), so that the chemical activity of the living cell does not differ from the action of chemical ferments. According to Fischer, the fermentation of polysaccharides is always preceded by the hydrolysis of sugar. But there exists an exact relation between the molecular structure of a given sugar and the sugar-inverting enzyme of the yeast cell; if the sugar comes into contact with the albuminoids of the yeast cell, which play the most important part among the agents of which the living cell makes use, the sugar is decomposed only if the configuration, the geometrical structure of its molecules, does not deviate too much from the configuration of the molecules of the albuminoids.

Furthermore, Buchner has recently shown that the juice obtained from yeast cells by hydraulic pressure is capable of quickly fermenting highly concentrated sugar solutions of various kinds, even after it has passed through a Berkefeld filter. He infers from his experience that the fermentative power of the expressed juice is embodied in a soluble enzyme-like substance isolated from the living cell plasma.

However, it has been demonstrated repeatedly by independent observers that a vessel filled with unfiltered grape-juice and divided into two parts by a thin layer of cotton-wool shows active fermentation only in that portion into which yeast cells are introduced. Since such a partition is incapable of prohibiting the free passage of soluble enzymes, we must conclude that the direct contact of the yeast with the fermentable substance is necessary. In other words, it has been shown that the active cause of fermentation is a substance which is not normally thrown off by the cells, but which may be extracted from them by destroying the inherent properties of the cells, including their vitality. That the function of vitality is not identical with that of fermentation is proved by the facts of attenuation already mentioned. I conclude, therefore, that the active ferment is not a secretion of the ferment micro-organism, but is an inherent property of the cell, which may be destroyed, but not extracted without destroying the vitality of the micro-organism.

It may be well to keep in mind the fact that the products of fermentation inhibit the activities from which they result. Alcohol, for example, inhibits vinous fermentation, when its accumulation in the solution has reached a definite combination. When this equilibrium is reached the sugar is immune to the activities of the yeast cell, and alcohol is the immunizing agent. This is not a phenomenon characterizing vinous fermentation alone, but is, on the contrary, common to all fer-

mentations. Nor is it a chemical combination between the factors involved, but must be a physical equilibrium (if I may use the term), because of the fact that the removal of a portion of the alcohol results in fermentation again, becoming active until the requisite percentage of alcohol has again accumulated.

INFECTION AND IMMUNITY. Infection may be defined as that condition of the body resulting from the entrance and the multiplication of micro-organisms which cause to be produced organic poisons whose effects upon the organism are the symptoms of disease. The introduction of pathogenic products alone may cause symptoms and lesions of infection, but the resulting condition in this case is not communicable, as the presence of living pathogenic microbes is necessary to the possession of this latter quality.

The following characteristics are possessed in common by pathogenic and ferment micro-organisms: (1) They are specific in their activities. (2) The power possessed by ferment micro-organisms to produce specific ferment products is manifested by pathogenic micro-organisms as a power to produce specific pathogenic products; but the results obtained with either species of micro-organism, ferment or pathogenic, will vary with the environmental conditions of heat, soil, light, etc., under which the micro-organisms are placed. (3) With both species the capacity of the micro-organism to do specific work, as fermentation in the one instance and pathogenesis in the other, may be modified, lessened, or increased temporarily or permanently, without visibly changing the vital characteristics of the micro-organism whereby it lives, grows, assimilates, and propagates. (4) It has been shown that the function of cell vitality of both species of micro-organisms is not identical with the capacity of the cell to do specific work—ferment or pathogenic—and that the latter function is an inherent property which can be variously modified or destroyed by natural or by artificial means, but which cannot be extracted without destroying the vitality of the cell. (5) The products of cell activities—ferment and pathogenic—are inhibitory substances, antibodies, which tend by accumulation to arrest the processes of which they themselves are the results.

Immunity of an organism to infection may be an acquired or a con-

Immunity of an organism to infection may be an acquired or a congenital condition. Once acquired immunity may be partial or complete, temporary or permanent. The means of defense against infection which an organism acquires is not the same in all cases. In one form of acquired immunity the organism is capable of neutralizing the toxins, antitoxic immunity. In another form of immunity the organism is able to destroy the invading bacteria, antibiotic immunity. In another form of acquired immunity the protection enjoyed by the organism is due to conditions which prevent the production of toxins in its tissues by a species of pathogenic bacterium. This form I will call

somatic immunity. But since immunity of the organism, whether this be congenital or acquired, partial or complete, transient or permanent, antitoxic, antibiotic, or somatic, is an ability of the organism to resist infection, we should not lose sight of the important fact that there is a necessary and intimate causative relation between the bodily condition of the organism which predisposes to infection and that condition which resists infection, and, further, that an explanation of one of these conditions will serve to also explain the other condition.

Maxwell says: "Molecules (atoms) exist of various kinds, having their various periods of vibration either identical or so nearly identical that our spectroscopes eannot distinguish them. The same kind of molecule (atom), say that of hydrogen, has the same set of vibrations whether we procure the hydrogen from water, from coal, or from meteoric iron." In other words, physical science teaches that atoms are not only in constant motion, but also that such motion characterizes the atom moving; as, for example, all hydrogen atoms have the same sort of motion, likewise oxygen atoms, nitrogen atoms, etc.; each kind has its own definite vibration period. Lord Kelvin's vortex hypothesis not only attributes to each kind of atoms its distinctive motion, but also hypotheeates that the motion of the atom is the sole character which distinguishes it from other kinds of atoms.

To explain the phenomena of the universe we must recognize the presence of a continuous universal medium that pervades all space—the luminiferous ether. This medium which serves to connect all bodies, such as molecules and atoms, also receives and transmits their motion through space as ether waves; spectrum analysis is based upon this physical law.

We furthermore learn from physics that ether-wave motions, like water and sound waves, are subject to the beautiful law discovered by Dr. Thomas Young, the author of the undulating theory of light, ealled the "law of wave interference." Sir John Herschel says: "This principle regarded as a physical law has hardly its equal in beauty, simplicity, and extent of application in the whole circle of science."

When two sets of water waves whose troughs and crests correspond in time of recurrence meet, their amplitude will be increased—the dimension of the resulting waves will be enlarged; vice versa, when the periods of wave recurrence do not correspond, but the troughs of one set correspond with the crests of the other set, the resulting waves will be quenched, destroyed. Similarly, waves of sound and waves of sunlight will be intensified, quenched, or modified in various ways by other sound or light waves, according to the amount of interference that exists. This is a simple if crude illustration of the law of interference, and serves to illustrate how atomic and molecular ether waves may be influenced by the same agency.

When considered in the light shed upon the subject by the fermentation theory the term molecular structure ceases to be a meaningless name, the source and nature of cell energy becomes more intelligible, and the yeast cell no longer appears a structureless mass of enclosed protoplasm, but a machine of great complexity and capacity; we mentally behold a countless number of atoms in orderly arrangement within the molecules of the cell, vibrating in time and periods that are distinctive and imparting their own motions to the surrounding ether within the molecules. We further mentally behold a wondrous conflict of the atomic ether waves produced within the molecules which, in harmony with the law of interference, finally results in an adjustment of the conflicting waves, and in the production of a set of ether waves specific in character and which represent the molecular structure of the cell.

The adjusted waves are the resultant of the following factors: (1) The kinds of atoms comprising the molecule; (2) the particular manner in which the atoms are grouped, constituting molecular structure; and (3) interference of atomic ether waves. The set of ether waves resulting from an adjustment by interference of the atomic waves we will call molecular ether waves, and as they represent molecular structures they will, consequently, vary in their distinctive characters with variations in the structure of molecules. Ether waves possess energy, hence molecular other waves represent molecular energy, which necessarily varies in character with variations in molecular structure.

The energy of a cell, say an yeast cell, will then be the sum of the energy of its contained molecules, provided the molecules are the same in structure. Excluding from our calculation the cell molecular groups that are directly concerned in the vegetative operations of the cell, it will be more accurate to say that the energy of an yeast cell is the sum of energy possessed by its molecular groups which are concerned in bringing about fermentation. It necessarily follows as a corollary of these principles that the distinctive energy possessed by cells of various kinds, as bacteria and ferment cells, is a result in each case of distinctive molecular structure of the cell.

It should be noted that the distinctive or special energy of a cell, or of an enzyme, as pointed out by Emil Fischer, is manifested as a capacity to produce certain changes in those substances only which bear a definite relation in molecular structure to that of the ferment or enzyme concerned.

Now, the exact relation in molecular structure of the ferment and the substance which Fischer describes as "configuration" and "geometrical structure" of the molecules, is, I hold, a similarity in molecular structure of the two bodies, and, therefore, a similarity in molecular waves and energy. In other words, the molecular waves of

the sugar and yeast cell (or enzyme) bear a definite relation in time and periods of recurrence, so that the waves of the two sets, when they meet, are intensified and the energy of the resulting waves is increased, possibly doubled. Under this wave influence the substance which is the least stable in chemical bonds—the sugar—is disrupted. The ether waves falling millions of times per second upon the sugar molecules, which vibrate in accord with the disrupting waves, are dissociated by the wave energy of the yeast.

Atoms which have just been freed from their chemical bonds, as in this instance, cannot long remain in a nascent condition; chemistry teaches that they must immediately recombine into other simpler substances. This is the condition of the sugar atoms—they have been driven from their combination and must recombine according to chemical law. We must keep in mind the fact, however, that in entering into new combinations the atoms are seriously handicapped as they must recombine against the energy of the ether waves that dissociated the sugar. It seems evident that no substance whose molecular structure is identical or too nearly identical with that of the particular sugar dissociated can form under the bombarding energy of the waves, as the energy which is capable of dissociating is also capable of preventing combinations of such substances.

Among the various substances into which the dissociated atoms may combine only those whose molecular waves are not in accord with molecular waves of the yeast are possible under this influence. It will be noted that a substance which is not in accord with yeast is not in accord with the wave energy of sugar, and it will oppose both. The substance is an antibody to vinous fermentation.

We have spoken of "accord" and "discord" or "dissonance" of ether waves to express certain relative phases of the waves. Waves that are in accord recur in the same periods of time; their troughs and crests correspond. Discordant or dissonant waves do not recur in the same periods of time, and the troughs and crests of one set do not correspond to but may oppose the troughs and crests of the other set. While such expressions are descriptive of water waves and sound waves, they may not be applicable to ether waves, but they serve the purpose intended, that of making clear the relations between ether waves, which I desire to explain.

We have already learned that ferment products are inhibitory bodies which tend to and in their accumulation do arrest the fermentation. Do we not find an explanation of this mysterious inhibition phenomenon in the conditions under which these bodies are formed? Alcohol, for instance, inhibits vinous fermentation, of which it is the principal product. We have seen that when alcohol accumulates in vinous fermentation this process will be arrested when the accumulation of

alcohol reaches a certain definite percentage. There may be unfermented sugar and yeast cells ready to ferment it, but no fermentation will take place while the percentage of alcohol remains. The sugar is immune to the activity of the yeast cells, and alcohol is the immunizing agent, because its wave energy opposes that of the yeast and sugar; it is, therefore, an antibody.

Stahl, 1707, is entitled to the credit of having first formulated a theory of fermentation and putrefaction in which the causes producing the phenomena are purely physical agencies—molecular disturbances in the fermenting fluids. This conception of the nature of fermentation was adopted by Liebig, 1842, who held that the molecular disturbances which bring about fermentation are motions of decay which are imparted to molecules of a fermentable substance by the molecules of the albumiuous substance undergoing decomposition. The molecular disturbances which cause fermentation are, according to Naegeli, 1852, the physical motions of atoms and molecules characteristic of these bodies.

The author's theory, while it is an outgrowth of that of Stahl, of Liebig, and of Naegeli, differs from these in important ways. For example, I hold that decomposition is caused not by direct bombard-ment, atom against atom and molecule against molecule, of the ferment upon the fermentable substance, as taught by Naegeli's theory, but that the conflict by bombardment which results in a dissociation and recombination of the fermentable substances into ferment products is between ether waves, atomic and molecular, produced by and corresponding to the motions of the atoms and molecules. The potential energy of the cell—say an yeast cell; that is, the capacity of the cell to do special ferment work—is a result of its structure, and is a reflex of its molecular ether waves. This potential energy of the cell becomes active or kinetic energy only when its waves meet in conflict with the waves of another substance, say sugar, which the former can decompose and transform into ferment products, alcohol, etc.

THE FERMENTATION THEORY OF INFECTION. Infection and fermentation, I hold, are analogous processes or phases of the same process and that both are due to the operation of the same physical and chemical laws. The active, obvious cause in both processes is a micro-organism or an enzyme, which is selective in its activity, in that a definite relation in molecular structure must exist between the acting substance and the substance acted upon before infection or fermentation can take place. The resulting products of the process, whether they be infectious or fermentative, are antibodies which tend to inhibit or to arrest the process of which they are the products.

The substances which pathogenic micro-organisms select to transform into the toxins of disease are the albuminoid molecules of the body

plasma. "The albumins or proteids are the most important foodstuffs which animals require for their existence. Albumins enter into the constitution of all the tissues and organs of the body and form the groundwork of every living cell. The phenomena of life, indeed, are dependent upon and centre in their presence.

"With few exceptions the food-stuffs which the animal derives directly or indirectly from the plant cannot be utilized by the animal directly, but they must previously undergo certain changes which vary with the character of the individual substances. The native albumins must first be transferred into albumoses and peptones; the dissaccharids and polysaccharids must be inverted into monosaccharids, and the fats must be emulsified. We have seen in the chemical laboratory that these changes can for the most part be brought about through the action of superheated steam, by boiling with acids and alkalies, etc.—that is, through agencies that are not at work in the living world. The question, therefore, suggests itself, What are the means at the disposal of living animals to bring about these changes? This question has, in a measure, been answered—the animal capable of bringing about a large. number of analytical changes by means of certain ferments or enzymes, which are furnished by the animal cells themselves. The better-known representatives of this class are essentially hydrolytic ferments, but there is evidence also of the existence of oxidation ferments.

"As the chemical processes which take place in the animal body are essentially of the character of hydrations and oxidations it would thus appear that other factors beside the ferments would be unnecessary for the functioning of the various organs. It is quite possible, indeed, that this is actually the same, and that the various manifestations of life may be explained upon the basis of fermentative phenomena."

Since the albumins of the tissue juices of the animal body constitute the pabulum from which its various tissues select nutritive substances required for their growth and the repair of their waste, the albumin molecules, using this term in the broadest sense, must exist in groups of many isomeric forms; and, while these groups possess the chemical and physical properties of albumin, they differ among themselves in greater or less degree in molecular structure. This conception of the molecular structure of the pabulum not only affords an explanation how body tissues of different kinds appropriate from a common source and transform into their own substance nutritive materials of the pabulum, but it also supplies an explanation how various kinds of micro-organisms find in the pabulum albuminoid groups which they can transform into kinds of toxalbumins.

We must not overlook the fact, however, that the tissue juices of

the animal body are essentially vital, and that the resistance of the molecules to decomposition is due to the same vital influence, probably of the nervous system, that resists destructive changes in the organism as a whole. This being true, groups of homologous molecules, whose structure bears certain exact relations to the molecular structure of certain micro-organisms, will more or less successfully resist dissociation by bacteria, i. e., the animal body will resist infection by micro-organisms, according to the degree of normal resistance that is possessed by the molecules or by the organism. At the same time depressing influence, such as fear, fatigue, injurious drugs, emotional disturbances, etc., by diminishing resistance opens the road to infection.

Pathogenic Micro-organisms. A micro-organism is pathogenic to the animal body only when the latter contains molecules of albumin (proteid) which the former can transform into toxalbumins. Hence a micro-organism may be pathogenic to one species of animal, whose tissue juices contain susceptible albumin molecules, and not pathogenic to another species or variety of the same species of animal whose body juices do not contain susceptible albuminoids. Immunity of the animal body to a given micro-organism or to the disease caused by that microbe, as will be explained later, is due to the absence by destruction or inheritance of molecules of albumin which are susceptible to the special energy of the micro-organisms of the disease. Such micro-organisms are then not pathogenic to this organism, and they may remain in its tissues without producing specific disease.

A phenomenon that has proved a serious stumbling-block to the phagocytic theory of immunity is the markedly different behavior of the phagocytes to pathogenic bacteria in the bodies of immune and of susceptible organisms. In the immune animal the phagocytes flock to the point of invasion from long distances and attack and destroy the bacteria. The conditions are quite different when this same species of bacteria is introduced into the body of a susceptible animal. The bacteria are not now attracted by the phagocytes; on the contrary, they are repelled by them, in that the phagocytes retreat and permit the bacteria to infect the organism.

Under former teaching, that the pathogenic power of a bacterium is due to a secretion of the microbe, it is difficult to explain this phenomenon, but when pathogenesis is recognized to be the result of two factors—a species of micro-organism and a group of susceptible albuminoid molecules—the absence of either factor will prevent infection; and since the immune animal does not contain a group of albumin molecules which the micro-organism can transform into toxalbumins, infection cannot take place. The micro-organisms under such conditions are not pathogenic, and the phagocytes—the scavengers of the body—destroy them as they do other innocuous substances. In

the case of a susceptible animal the conditions are quite different. The body juices of such animals do contain susceptible albumin molecules which the micro-organism can transform into toxalbumins. It is these poisons that drive away the phagocytes and lead to infection, while it is the absence of toxalbumins in the immune animal that causes opposite phenomena to occur.

In concluding our remarks upon the nature and causes of infection, I wish again to emphasize the importance of certain principles which, I believe, are causatively concerned in the phenomena of both fermentation and infection, and, as will appear later, in those also of immunity.

The energy of a living cell, whether this be a ferment or a pathogenic cell, whereby the cell is made capable of doing special work, is derived from the ether waves which represent the molecular structure of the cell.

Since the manifestations of energy by living ferments and pathogenic cells are definitely associated with the molecular structure of such bodies, and since there are a vast number of species and varieties of both ferment and pathogenic micro-organisms, the capacity of such cells to do work which varies in character with the species and the varieties, is a reflex in each and every case of molecular structure. In other words, the manifestation of specific energy by ferment and pathogenic cells, which varies with the species and variety of the micro-organism, is a result of specific differences in molecular structure of the cells of the different classes.

The specific energy of the living ferment or pathogenic cell is capable of converting substances into ferment or pathogenic products whose molecular structure—that is, molecular waves—do not deviate too far from the molecular structure of the cell.

The energy of atomic and molecular ether waves is increased or diminished by related ether waves according to the degree of interference that results from their conjunction. When the waves of one set correspond in time and periods with those of another set, their conjunction causes an increase of wave energy; on the other hand, when the two sets of waves do not correspond in time and periods, but the waves of one set recur in periods directly opposite to the waves of the other set, the wave energy is apparently destroyed (quenched, antagonized) by conjunction of the two sets of waves.

Of the many theories of immunity but three have at present any considerable following. They are the humoral theory of Buchner and his associates, the cellular or phagocytic theory of Metschnikoff, and the side-chain theory of Ehrlich. According to the humoral theory the destruction of pathogenic bacteria in the living organism is due to the bactericidal action of the blood plasma. Buchner and his school have shown that freshly drawn blood, blood plasma, defibrinated blood,

aqueous humor, tears, milk, urine, and saliva possess marked destructive influence upon micro-organisms brought in contact with them, and that this influence is destroyed by exposure to sunlight, the mixture with serum from another species of animal, and by heating blood serum to 55° C.

In 1881 Carl Rosser called attention to a power which the phagocytes of both animals and plants have of incepting, digesting, and assimilating living micro-organisms; and he maintained, as a result of his observations, that leucocytes of an immune animal can destroy bacteria which are themselves destructive to susceptible animals. Metschnikoff, working on the same lines, confirmed the earlier observations of Rosser, and from observing what appeared to be a contest between the white blood cell of the water-flea and certain infectious micro-organisms, he was led to believe "that in every case of infection it is the white-cell elements of the blood that, as scavenger cells (phagocytes), have to save the organism if they can. If bacteria attack any part of the body, these cells, favored by their mobility, at once appear at the place of danger and rush upon the invaders. If they are able to make the latter innocuous, no affection takes place; if, however, these defenders of the organism struggle ineffectually and yield, the enemies begin to multiply and spread themselves over the unprotected domain."

The side-chain theory of immunity is an outgrowth of Ehrlich's studies into the nature of toxins and antitoxins, and it expresses his views of the nature of the changes in the tissues and plasma cells of the body which take place in immunization. Of the many atom groups which compose cell structure certain permanent groups are concerned in maintaining and perpetuating the cells, while other groups called "side chains" or "receptors," which are supposed to be multifarious in special chemical affinities and in numbers, are particularly occupied in cell nutrition. In the exercise of this function the "receptors" attract to themselves such nutritive material of the plasma or toxins contained therein which have special affinities for the "receptor," and though the intermediation of the receptors combine such substances with the cells. Now, infection of the cells by toxins is produced, according to Ehrlich, in the same manner and by the same agency that nutrition of the cells is produced. In this instance toxin molecules in the plasma which have the required affinities are seized by cell receptors, and through the intermediation of these bodies the toxins exert their harmful influence upon the cells themselves.

Certain anomalous results obtained by Ehrlich in standardizing diphtheria toxin led him to conclude that the toxin molecules have two distinct atom groups, one of which is destroyed by exposure for a half-hour to a temperature of 56° C., while the other remains active under this exposure. The thermostabile groups—the "haptophore groups"

or simply the "haptophores" of the toxin molecule—are concerned chiefly in neutralizing the toxin, while the thermolabile groups—called the "toxiphore groups" or simply the "toxiphores"—constitute the toxic part of the molcule. "Toxoids" are toxin molecules which have lost their "toxiphores," but retain their "haptophores." Ehrlich claims that the anomalous results he obtained in standardizing diphtheria toxin were due to the presence of toxoids in the sera.

Now, as a cell can be reached by nutritive stuff or by poison stuff only through the intermediation of specific receptors, and as the function of these bodies is destroyed or much impaired when they become infected, they must be cast off and reproduced, when infected, or the cell must perish from starvation.

It is assumed, therefore, that cells which have not been destroyed by the toxin, but have sustained injuries which they may overcome, will cast off the infected side chains, and will replace them by new ones, and in excess of the capacity of the cell to retain. The result of this excess in production of side chains is the appearance of "receptors" in the blood stream as free bodies, and as they retain their combining powers they may unite with homologous toxin molecules, and thus protect the cells from further infection by the toxin, and will give to the animal body thus protected antitoxic immunity, the free receptors being antitoxins.

The following phenomena are apparently not in harmony with this theory of antitoxic immunity. "Guinea-pigs and men who have withstood a tetanus infection and are very resistant may contain no tetanus antitoxin." Rabbits which have been immunized to tetanus will succumb to an intracerebral inoculation of a small dose of tetanus toxin. Many animals, such as rats, hens, and alligators, after inoculation with tetanus toxin, produce great quantities of antitoxin without previously showing any signs of the disease. Finally, in the production of antitoxin by toxin, say, of diphtheria, the quantity relations of the toxin to the antitoxin in the process are those of a ferment and its products, rather than those of a chemical combination. unit of toxin may cause the production of about 10,000 units of antitoxin; the production may be largely increased by repeated venesections of the immunized animal, so that there may be withdrawn a quantity of antitoxic serum out of all proportion to the quantity of toxin used; and yet, at the end, the animal can supply a serum of nearly the same antitoxic power as at first. This phenomena is strikingly like that which occurs in alcoholic fermentation, when by repeated removals of alcohol, arrested fermentation may be re-established and more alcohol produced. It seems that in both cases increased production following removal is due to the weakening or destruction of inhibitory influences which tend by their presence to arrest the processes.

Bacteriolytic immunity is due to specific lytic qualities which the blood acquires in adapting itself to infectious cells that have been introduced into the body. It has been shown that when various kinds of cells, their products or derivatives, are introduced into the peritoneal cavities of animals at certain intervals, the blood serum of the treated animals will undergo changes of the most exact and delicate kind, and that there will be developed antibodies in the plasma to the bodies introduced. For example, the introduction at intervals of attenuated infectious cells into a susceptible animal will, in the process of immunizing the animal, cause the development of lysins in its body which are capable of destroying such cells. If red blood cells are introduced, the serum of the animal treated becomes hemolytic; when epithelial cells or hepatic cells or spermatozoa are introduced, the serum is lytic for the epithelial, the liver cells, or the spermatozoa, according to the kind of cells introduced. If pathogenic bacteria are introduced the blood serum becomes lytic for the bacterium. It should be noted that the relation between the cells introduced and the adaptive changes which take place in the blood serum of the animal treated is exact and specific in character.

Ehrlich in his side-chain theory offers the following explanation of these phenomena, which, of course, includes those of bacteriolytic immunity. He concludes that the lytic power of blood serum resides in the thermolabile constituents of normal blood which he terms the "complement." The complement is incapable, however, of combining directly with foreign cells to be destroyed; an intermediate body is necessary. The intermediate body is a thermostabile substance which is found only in immune blood and called the "immune body," or more commonly the "amboceptor" as it has two atom groups, one of which unites with the complement, while the other unites with the cells that are to be destroyed. Complements and amboceptors are believed to exist in immune blood in great variety and of many chemical affinities, enabling them to exercise specific and exact selective powers.

The origin of amboceptors is believed by Ehrlich to be the same as that of antitoxin; but Metschnikoff, who has modified his views of phagocytosis so that they are more in harmony with Ehrlich's views, insists upon the phagocytic cells as the originators of substances concerned in cytolysis, and, in recognition of its ferment character, he has given the name "cytase" to the complement, and that of the sensibilizing substance (substance sensibilisatrice) to the immune body—amboceptor.

The natural resistance of the animal body to any given type of infection, which condition is not necessarily associated with that of robustness or vigor of constitution, may be lessened or temporarily destroyed by various means; for illustration, the natural resistance of

chickens to anthrax may be overcome by reducing the bodily temperature of the chickens (Pasteur). The natural resistance of rats to anthrax may be destroyed by forcing them to turn a revolving wheel until they become exhausted (Roger). The immunity of white rabbits to anthrax may be overcome by feeding or by injecting into them phloridzin, so as to induce a glycosuria (Leo). Now, assuming that natural resistance to infection is due to an absence or poverty of side chains, it is difficult to conceive how such absence or poverty can be overcome by the conditions mentioned.

The difficulties which confront the side-chain theory will be increased in magnitude and number when we seek an explanation of variability in duration of acquired immunity. To assume that immunity acquired from a given species of bacterium is due to the presence in the organism of specific amboceptors requires us to believe (a) that these bodies are continually present during the period of immunity—probably during the life of the person, (b) that there exists in the blood specific amboceptors representing each and every disease from which the person has acquired immunity, and, finally, as a condition of permanent immunity can only be maintained by a permanent supply of fresh amboceptors to replace those worn out, the side-chain theory requires us to believe that these bodies possess the power of reproduction.

The forces involved in the fermentation theory of immunity are those operating in nature within and without the living organism. They are the forces which constitute motion in matter, and are the same when manifested in the operations of the telephone, the phonograph, or in wireless telegraphy, that they are in bringing about atomic rearrangement in albumin molecules in the production of immunity. The centres of activity of these forces in the production of acquired immunity are the albumin molecules of the plasma and tissue cells of the living organism. It is known of these bodies that they are massive in size, complex in structure, unstable in composition, are plastic in adaptive processes, and that the distance from normal albumin to poisonous toxalbumin is not far. Further, it is believed that albumin molecules of the body juices and cells exist in homologous groups of great variety-isomers of albumin. That similarity in atomic arrangements and in molecular energy between the molecules of the plasma and the cells of the body affords the latter selective activities in nutritional processes, and in the same way a similarity in molecular structure and energy of a toxin or of foreign cells and plasma albumin molecules will give the former selective power in producing infection and immunity.

It is seen, therefore, that the fermentation theory, in many respects, runs parallel to the side-chain theory of immunity; especially so, when

we consider the tendency of modern science to refer chemical action in its ultimate analysis to physical motion.

The source of energy manifested by a pathogenic micro-organism has already been described, and it has also been shown how such energy brings about a dissociation of susceptible albumin molecules of the living body, and why the dissociated atoms recombine into antitoxins and thus cause the development of antitoxic immunity of the organism.

As this form of immunity is due to neutralization of the toxin by the antitoxin, and as it has neither bacteriolytic power nor the ability to prevent the conversion of albumins into toxalbumins by the microorganisms of the disease, it is necessarily short-lived.

It is a matter of common observation, however, that immunity which follows an attack of disease in many forms of infection, and also that which follows inoculation with the toxin or with attenuated forms of the microbe, may be of long duration, possibly during the life of the person. This form of immunity is generally believed to be due to an acquired capacity of the immune body to destroy invading bacteria, and is, therefore, called "bacteriolytic immunity." Those who hold to this theory are called upon to explain the following phenomena which seriously militates this view, and which, so far as I know, remains unanswered. The bacillus typhosus may remain as a harmless parasite in the gall-bladder and in post-typhoid bone abscess in immune persons for years; the bacillus subtilis may remain unattacked in the infected spleen for an indefinite period of time. Query—Why does not the bacteriolytic serum destroy the microbes, and why is the patient not reinfected by the bacillus typhosus?

These difficulties do not confront the fermentation theory, which holds that two factors are necessary to infection of the living organism, viz., (a) the presence of susceptible albuminoids, and (b) the presence of the pathogenic micro-organism. The absence of either factor will prevent infection.

Now, I call the second form of immunity, that which usually, but not necessarily, gives long protection to the organism, somatic immunity, in contradistinction to the first variety, antitoxic immunity. The operating factors in the two varieties are the same, but the effects produced are different. There is a complete dissociation and a rearrangement of susceptible albumin molecules into antitoxin—a foreign and non-nutritive substance—in antitoxic immunity; while in somatic immunity, the susceptible molecules are not dissociated and do not lose their nutritive value, but the atomic arrangement of the molecules is changed by the energy of the toxin, and in consequence of this such molecules lose the susceptibility to the micro-organism that previously existed. It follows, therefore, that the micro-organism previously

pathogenic to the person is no longer so, and it may remain indefinitely and without harm in the tissues of his body.

In speaking of the susceptibility of albumin molecules to the energy of the toxin of a given micro-organism, we must not lose sight of the relation in molecular structure, pointed out by Emil Fischer, between a ferment and the substance it can decompose, and which must exist, before the one can affect the other. This relationship must also obtain between the molecular structure of the micro-organism and homologous groups of albumin molecules before the micro-organism can convert the molecules into toxin. Now, the toxin is necessarily an antibody to the micro-organism just as alcohol is an antibody to the yeast cells; it is, also, an antibody to other substances whose wave energy coincides with that of the micro-organism. The group of susceptible albuminoids come in this category, and the toxin is, therefore, an antibody to this group just as alcohol is an antibody to grape-sugar.

This explanation will enable us to better understand the rationale of action between the toxin, the micro-organism which produced it, and the susceptible group of albumins whose molecular structure may be rearranged by the toxin and thus thrown out of harmony with and consequently immune to the micro-organism. It will be noted that the toxin is an antibody both to the group of susceptible albuminoids and the micro-organisms, and as the two last named must coincide in wave energy that one may dissociate the other, it follows that the wave energy of the toxin must oppose both alike. We are now confronted by two facts: the first is that the wave energy by which the toxin attacks the albuminoid group is not a direct energy, such, for example, as is that which results in the production of antitoxin, but is a reverse energy—that is, an opposing energy; our second fact is that the toxin is an enzyme and is more stable in atomic bonds than are the albuminoids. Now, when reverse wave currents meet, one will destroy the other if their energies are equal; when they are not equal the stronger will first neutralize the wave energy of the weaker, and then with the remaining energy will cause an atomic rearrangement in the molecular structure of the weaker substance—the susceptible groups of albumin molecules. We can readily understand why this energy may not be sufficient to dissociate and yet be ample to produce a molecular rearrangement in the weaker body. Now, a molecular rearrangement of a substance, say, of an homologous group of albumin molecules, may destroy the susceptibility to a given species of bacterium without destroying the nutritive value of the molecules. Molecules thus changed will be thrown out of harmony in synchronous molecular vibration with the species of bacterium to which they had previously been susceptible and cannot be transformed into toxins by this species. Somatic immunity, I hold, is a condition of atomic rearrangement of susceptible molecular groups of the organism, so that their susceptibility to a given species of bacterium is more or less permanently destroyed. Since the albumin molecules are susceptible to micro-organisms because of certain structural similarities held in common by the two, susceptibility will be destroyed, and this group of molecules will become immune to the micro-organism when the structural similarities held in common cease to exist. It is understood, of course, that immunity of the albumin molecules carries with it immunity of the organism, and that permanency in duration of one coexists with permanency in the other.

The more permanent duration of protection which usually characterizes the somatic type of immunity, and that which distinguishes this type from that produced by antitoxins, is due to the fact that atomic rearrangements of albuminoid groups, brought about by reverse-wave energy of the toxin, show a marked disposition to permanency.

The contention that atomic rearrangement may be permanent in character is not unsupported by evidence; it is well known that changes in molecular cell structure may be produced artificially and that such changes may be transmitted from parent to progeny through many generations of the cells. I refer to the changes produced in cells by "attenuation." It has been shown that the capacity of a ferment or pathogenic cell to bring about decomposition changes in susceptible substances and to produce specific products may be increased or decreased, destroyed and restored at the will of the operator by exposing such cells to attenuating influences or agencies. It has further been made known that the capacity of a cell to produce ferment or infectious products is not a vital capacity, inasmuch as it can be destroyed without doing injury to the cell in its capacity to grow, to assimilate or to propagate itself. Since the capacity of a cell to excite fermentation or pathogenic changes is not a vital capacity, and since this capacity may be variously modified or destroyed by physical agencies, I have argued that the forces concerned are physical, and have pointed out their nature and origin. Now, since the condition of "attenuation" of bacteria and ferment cells is due to atomic rearrangement of cell structure, which may become permanent and may be transmitted from parent to progeny, and since the changes produced in the plasma and tissue cells of the body by toxins are also atomic rearrangements, the same degree of variation in permanency of acquired structure will apply alike in both cases.

Before concluding this essay, it is but fair that I point out as I see them what may be regarded as weak places in the fermentation theory. The existence of atoms has never been absolutely proved, the atomic theory being accepted as true because it serves to explain and make intelligible chemical phenomena which otherwise would be obscure and inexplicable.

The evidence that atoms (molecules) possess a motion of translation and that this is the source of radiant heat is almost positive; but the proof that they also possess an interior motion is less conclusive. Many scientists believe, however, that atoms not only have interior motions, but that such motions are primordial and ultimate, and are therefore indestructible. "That the molecule (atom) does not get its interior motion from the heat of dissociation is certain, for on being allowed to recombine it yields up its translatory activity and with it as many degrees of temperature as disappeared in accomplishing its dissociation. We must not endow the molecule (atom) with gratuitous attributes, but it is surely an entity of some kind, having, in the first place, persistent and regulated motion; secondly, it has inertia, or mass, the property of conserving "vis-viva." Thirdly, it has some bond with its fellow by which the motions of both are modified by constant stress, according to a definite law of distance; and this, following Newton, we call attraction. Fourthly, it has the complex property of interchange of momenta, accompanied by that of conserving the compounding motion by angular rebound upon an infinitely near approach, which we call 'resiliency' or 'repulsion.' It is conceived as having dimension, figure, polarity, elasticity, and harmonic vibration, with periods as undeviating as those of the 'moons of Mars.'"

The fermentation theory is based upon the hypothesis, in the absence of positive supporting proof, that the interior motions of atoms are transmitted to the surrounding ether as wave motions of energy, just as the translatory waves of atoms are transmitted in the development of ether waves of radiant energy, heat, and light. Proof that the interior specific motions of atoms transmit to the ether related vibrations (waves) must rest for the present, as the atomic theory does, upon the competency of this theory to intelligently explain large groups of physical phenomena which otherwise are obscure and inexplicable.

Professor Julius Thompson (thermochemical investigation) says: "Theoretical chemistry is based upon the molecular theory, according to which all matter is made up of molecules and these molecules of atoms. The physical state of bodies depends upon the arrangement and motions of the molecules; the other physical and chemical properties depend upon the kind and number of atoms in the molecule, upon their arrangement and relative motions."

Now, this statement as it stands does not convey to the mind how "the number and kinds of atoms in the molecule, their arrangement and relative motions," give to matter the chemical and physical properties it possesses. The statement is simply one of fact, and is not an explanation of the nature of the forces which bring about the chemical and physical changes referred to. The chemical and physical properties of matter and the rationale of their action will become intelli-

gible, however, when it is understood that the latent or potential energy of matter is the sum of energy of its molecular ether waves which become active or kinetic energy, capable of molecular dissociations and reassociations when, under favorable conditions, it is brought in contact with molecular structure whose wave energy bears a definite, required relation to the molecular wave energy of the first.

Michael Foster, in discussing physiological problems, has this to say: "We have, in speaking of protoplasm, used the words construction," decomposition," and the like, as if protoplasm were a chemical substance. And it is a chemical substance, in the sense that it arises out of the union or coincidence of factors which can be resolved into what the chemists call 'elements,' and it can be at any time by applying the appropriate means, broken up into the same factors, and, indeed, into chemical elements.

"This is not the place to enter into a discussion of the nature of the so-called chemical substances, or, what is the same thing, a discussion concerning the nature of matter; but we may venture to assert that the more these molecular problems of physiology with which we are now dealing are studied, the stronger becomes the conviction that the consideration of what we call 'structure' and 'decomposition' must, in harmony with the modern teachings of physics, be approached under the dominant conception of modes and motion.

"The physicists have been led to consider the qualities of things as expressions of internal movements; even more imperative does it seem to us that the biologist should regard the qualities (including structure and composition) of protoplasm as in like manner the expression of internal movements.

"We must not pursue the subject any farther here, but we feel it necessary to introduce the caution concerning the word substance; we may repeat the assertion that it seems to us necessary for the satisfactory study of the problems on which we have been dwelling to keep clearly before the mind the conception that the phenomena in question are the result, not of properties of the kinds of matter, in the vulgar sense of the word, but of kinds of motion."

The "kinds of motion" in matter capable of producing "the phenomena in question" are not described by the distinguished physiologist and author whom I have quoted. The motions of atoms and molecules do not of themselves satisfy the understanding, as such motions alone are incapable of accounting for the energy manifested specifically by matter in its various forms. Something else is needed to make the forces of "construction," "decomposition," and the like intelligible, and this something, I claim, is supplied by the theory that vibrating atoms produce in the ether corresponding vibrations.

REVIEWS.

ANATOMY OF THE BRAIN AND SPINAL CORD, WITH SPECIAL REFERENCE TO THE GROUPING AND CHAINING OF NEURONES INTO CONDUCTION PATHS. For Students and Practitioners. By HARRIS E. SANTEE, M.D., Ph.D. With a preface by WILLIAM T. ECKLEY, M.D. Third edition, revised and enlarged. Chicago: E. H. Colegrove, 1903.

A CAREFUL and clear description of the anatomy of the central nervous system is given in this book by an author who thoroughly understands his subject, and possesses the by no means common faculty of being able to present it intelligibly to his readers. In the following order are described the membranes, the external surfaces of the cerebrum, the ganglia, the third ventricle, and interbrain. The reader is then led through the mid-brain to reach a chapter in which the neurones and their functions are explained; the cortical ganglionar and central gray matter detailed in its ultimate structure; and the projection, commissural, and association fibres traced. This takes one half through the book. Hind-brain or cerebellum, after-brain or medulla, fourth

ventricle, and spinal cord are well treated in the order given.

It must be said that Dr. Santee's book lacks one very important feature in a work of this kind; namely, plates and diagrams. Only two illustrations appear—the mesial and external surfaces of the brain. So necessary are pictures to an adequate understanding of this intricate subject, that the cleverest description would be likely to embarrass the student whose mind did not already carry graphic representations in their absence. In connection, however, with other works containing them, and the possession of material for macroscopic and microscopic study, the book has its distinct value, as the author at times has an original manner of presenting intricate portions of the subject, so that points difficult of understanding are simplified. For instance, in describing the internal capsule, he speaks of it as a "funnel-like group of fibres." "The bell of the funnel opens upward and outward, and contains the lenticular nucleus; its solid spout, directed toward the pons and medially, is the crusta. Anteroinferiorly the fibres in the bell of the funnel diverge to opposite sides of the fissure of Sylvius and produce a break in its continuity, the hiatus Sylvii; otherwise the funnel is complete. As the internal capsule proceeds into the hemisphere, it impales the corpus striatum in such manner as to place the caudate nucleus and amygdala upon the circumference, and to inclose within its walls (to capsulate) the lenticular nucleus." This helps the student to form a conception, that he must build from sectional views, of the relations in all dimensions of capsule to ganglia, etc.

The book is made more interesting and impressive by frequently mentioning the functions, when the anatomy of regions or paths is

detailed. With the description, for instance, of the anterior horn cells are the clinical results of their degeneration pointed out. There is a chapter on the "Tracing of Impulses," which sums up in an able manner the paths conducting motor and sensory impulses and the reflex acts. The book very properly ends with a section devoted to the embryology of the nervous system. A very complete index and the space offered for notes or drawings by interleaves throughout the volume are conveniences.

H. C.

Modern Materia Medica and Therapeutics. By A. A. Stevens, A.M., M.D., Lecturer on Physical Diagnosis in the University of Pennsylvania; Physician to the Episcopal Hospital and to St. Agnes' Hospital; Fellow of the College of Physicians of Philadelphia, etc. Third edition, entirely rewritten. Pp. xiv., 663. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

WE recall very distinctly the predecessor of this edition—a very readable and reliable book. The present comes to us rewritten as the advances in the subjects considered demand and the experience of the author enlarges. Not only by its larger size and its more positive statements does it appeal to us, but especially because the author has recognized that an arrangement of methods and materials according to the initial letters of their names is not the best for the student who wishes to know relations as well as facts. The alphabet as a source of classification—if classification it be—has been abandoned and pharmacology substituted. This arrangement, based on pharmacological action, is, to our mind, a great improvement; imperfect as our information may be, facts correlated are more easily acquired than facts isolated. After general considerations, including definitions, various information con-cerning composition and preparation of drugs, incompatibility, methods of administration, and circumstauces modifying the effect of drugs and and their dosage, we come to a consideration of these remedial agents, beginning with circulatory stimulants on page 38, and ending with various flavoring agents on page 466. Here the various official drugs and approved new pharmacopoial remedies are forcibly and fairly presented, both as to their physiological action and therapeutic uses. As for the orthography of this section, as well as of the rest of the book, it is certainly advanced, and so far as pharmacopæial terms are concerned, it is premature. If the terms fixed by established authority happen not to be in harmony with editorial notions, they should remain caudate until that authority moves. Remedial measures other than drugs are briefly presented and dismissed in thirty-two pages.

Applied therapeutics begins with acute infectious diseases, constitutional diseases, those of the blood and ductless glands, digestive tract, respiratory system, circulatory system, kidneys, and ends with diseases of the nervous system. If the reader expects that this will be merely an expansion of the perfunctory and thoroughly unsatisfactory index of diseases he will be mistaken, for here some of the author's best work shows itself. There is also evidence of extensive reading and judicial discrimination. We have perused this later presentation of the author's knowledge with great interest and, we trust, profit. We find this edi-

tion, both in scope and arrangement, a decided advance over its predecessor, and we predict that in these respects its appreciation by the profession will keep pace.

A CHART OF THE THREE GREAT SYSTEMS—ARTERIAL, VENOUS, AND NERVOUS. Published by Dr. G. H. Michel & Co.

THE chart is of a human figure, thirty inches in height, showing in a good deal of detail the arterial, venous, and nervous systems, with their branches, ramifications, and relations to each other and to other parts of the human anatomy. It is printed on canvas in bright colors, and should be of some value in elementary teaching. There is a brief text in explanation at the sides of the picture corresponding to letters and numbers on the figure itself.

G. M. C.

A TREATISE ON MATERIA MEDICA AND THERAPEUTICS, INCLUDING PHARMACY, DISPENSING, PHARMACOLOGY, AND ADMINISTRATION OF DRUGS. By RAPHALDAS GHOSH, L.M.S. Cal.Univ., Lecturer on Materia Medica, Calcutta Medical School. Calcutta: Hilton & Co., 1903.

A WORK on materia medica and its allied branches is rarely considered an attractive subject for steady reading, but rather as for reference, and as such this volume will be of use. It is written for the use of medical students, particularly those of the Calcutta Medical School, and while rather too voluminous for an ordinary text-book, it should be placed in the category of those books designated in the catalogues of American medical schools as collateral reading. It is an exhaustive work, going into the different branches of the subject in considerable detail; but one gets the impression of its subject-matter being crowded together and abbreviated to suit the requirements of a single volume. It is poorly bound and printed on poor paper, and there are many typographical errors. The fact that it is arranged to correspond to the British Pharmacopæia detracts considerably from its value to an American student.

G. M. C.

A TEXT-BOOK OF THE HISTOLOGY AND MICROSCOPIC ANATOMY OF THE HUMAN BODY, INCLUDING MICROSCOPIC TECHNIQUE. By LADISLAUS SZYMONOWICZ, Extraordinary Professor of Histology and Embryology in the University of Lemberg. Translated and edited by John Bruce MacCallum, M.D., Johns Hopkins University, Baltimore. Illustrated with 277 engravings, including 57 plates in colors and monochrome. Philadelphia and New York: Lea Brothers & Co., 1902.

THE volume before us is a veritable pleasure, and the instructor and student whom good fortune leads to secure it will find themselves in an enviable position from which to study histology and microscopic anatomy.

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A text-book which comes to us under the sign and authority of so distinguished an investigator in the field of microscopic anatomy as Dr. MacCallum is sure to find a ready place and hearty welcome, and an examination of the contents fully justifies the high position accorded it. The text is admirable, and the illustrations, both colored and other, as

good as the publisher's art can make them.

The volume is based upon the valuable plan of tracing, as far as may be, the development of the organs and the histogenesis of the tissues, from which viewpoint the histology is considered. The editor has, moreover, emphasized the structural units of organs with which idea the work of his master, Professor Mall, has been so richly rewarded. Besides the original descriptions and plates, many additions have been introduced, as in the section on the medulla and mid-brain, where the invaluable assistance of Dr. Florence R. Sabin has been available, and in still other sections, i. e., the lymphatic glands, where Calvert's diagram is introduced, and the adrenal, in which Flint's reconstruction is made use of.

The descriptive diagrams with which many of the full-page lithographs are supplied are excellent. No better method for unravelling the intricacies of microscopic anatomy is available, and the fulness, precision, and clearness of both drawings and descriptions are most commendable.

LE TRAITEMENT DE LA CONSTIPATION. Par le Dr. Froussard. Paris: J. B. Ballière et Fils, 1903.

This short treatise on the treatment of constipation is, as the title implies, chiefly devoted to physiological methods of treatment, including massage, hydrotherapy, electrotherapy, and gymnastic exercises, and contains many useful hints for the management and cure of this baffling and annoying symptom. The author's conception of the pathology of constipation is not without originality. He divides the cases into three groups, according as spasm or atony—the two principal causal conditions—predominate or coexist and alternate one with the other. In the first group the large intestine is resistant, contracts vigorously and even painfully on excitation with the palpating hand; there is distention, but not dilatation. The second group is characterized by both spasm and atony; that is, the two conditions alternate. The bowel is described as in a condition of "exaggerated and temporary repose." The third group, which comprises the most inveterate cases, is marked by a total absence of spasm; the intestine cannot be felt directly, and its position in the abdomen can be made out only by palpating the fecal contents. Great stress is laid on the necessity of recognizing the presence of spasm, as it has an important bearing on the choice of therapeutic methods. At first only functional, the hypertrophy of the muscle if it persists becomes structural, and unless the muscular coat is relieved of the extra work hypertrophy is eventually replaced by atony. Treatment is discussed under two heads, that of spasmodic and that of atonic constipation. These chapters contain full directions as to regimen and diet, as well as a description of the various electric, hydrotherapeutic, and mechanotherapeutic methods of treatment, with their indications

and full technical directions. Massage and hydrotherapy, including the internal use of water or "coloclysis," the technique of which is fully described, should form the main dependence of the therapeutist; laxatives are admissible solely for the purpose of exciting a single evacuation, never as routine remedies.

R. M. G.

"LES ACTUALITÉS MÉDICALES." LA GOUTTÉ ET SON TRAITÉMENT. By E. APERT. Paris: J. B. Ballière et Fils.

APERT presents in this work, which is one of a series of essays, an admirable review on gout. He gives the classical picture of gout, and, as would be expected, has drawn most of his material from English sources, although Trousseau, Dielaufoy, Bouchard, Béclère, and others have been freely quoted. Several radiographs illustrating the difference in the affections of the joints in gout and chronic rheumatism are of value, as well as those of the deformities and the tophi commonly seen in severe cases. The chapters on the Attack of Gout; Gouty Temperament: Gout, its Evolution, Abarticular Forms and Etiology, present the classical picture so often described.

The chapters on treatment are thorough, and especially interesting are those relating to the hydromineral treatment and to the newer remedies, all of which are mentioned, as is their composition. The chapter on Hydromineral Treatment should prove especially valuable when one is in doubt as to which particular bath or cure a certain case be referred. Apert aptly closes by insisting on the value of care, diet, exercise, and hygiene as far exceeding the value of any or all drugs. E. A. H.

ATLAS AND EPITOME OF HUMAN HISTOLOGY AND MICROSCOPIC ANATOMY. By Dr. Johannes Sobatta. Edited, with extensive editions, by G. Carl Huber, M.D. Authorized translation from the German. With 171 illustrations on 80 lithographic plates, and 68 text illustrations. Philadelphia and London: W. B. Saunders & Co., 1903.

The poverty in the English language of text-books on histology has been turned in the last few years into a state of plentitude that is rapidly becoming embarrassing. The teacher of histology is confronted at this day, in the selection of a text-book for students, with a perplexing problem, but the perplexity arises not from the inadequacy of the available books, but because of the difficulties of choosing between those of excellent merit. This condition is, to say the least, a desirable one, and one that reflects the changes which have come over the manner of teaching histology in medical schools. The growth of laboratories and of objective teaching of all kinds, and the replacement of "show" specimens of cells and tissues with the objects prepared by the student, whose property they become, have brought, by necessity, an improved form of manual adapted to the wider uses of a broadened course in histology. Two essentials are now required of a text-book on histology: the text

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should be modern and prepared by a specialist, and the illustrations should be copies from nature and reproduced with becoming fidelity. These essential conditions are easily fulfilled by the volume under consideration. The author and the editor both are distinguished histologists; the text is, therefore, of the utmost trustworthiness, to which may be added that it is also written with such degree of lucidity that the student is never at a loss to interpret the meaning. The illustrations are above criticism, and of such number and variety as to supply every wish, not only of the student, but also the more advanced scholar of histology. The English language has been greatly enriched by the addition to it of the present volume, and both editor and publisher are to be felicitated upon their excellent work.

A SYSTEM OF PHYSIOLOGIC THERAPEUTICS. A Practical Exposition of the Methods other than Drug-giving Useful in the Prevention of Diseases and in the Treatment of the Sick. Edited by Solomon Solis Cohen, A.M., M.D., Senior Assistant Professor of Clinical Medicine in Jefferson Medical College. Vol. V., Prophylaxis, Personal Hygiene, Civic Hygiene, and the Care of the Sick. By Joseph McFarland, Professor of Pathology, Medico-Chirurgical College, Philadelphia; Henry Leffmann, M.D., Professor of Chemistry in the Woman's Medical College, Philadelphia; Albert Abrams, A.M., M.D., formerly Professor of Pathology, Cooper Medical College, San Francisco; and W. Wayne Babcock, M.D., Lecturer on Pathology and Bacteriology, Medico-Chirurgical College, Philadelphia. Illustrated. Philadelphia: P. Blakiston's Son & Co., 1903.

In this volume of what may properly be termed an Encyclopædia of Physiologic Therapeutics is given what the editor is modestly pleased to call an Epitome of what is Essentially the Natural History of Medicine and an Introduction to the Science of Medicine. It treats, as is stated in the preface, "especially of the preservation of health and the prevention of disease, seeking a basis for intelligent prophylaxis in a study of morbid processes and their causation." In Part I., on the Origin and Prevention of Disease, by Drs. Joseph McFarland and W. Wayne Babcock, are presented, with great clearness and thoroughness, health and its defences; the intrinsic factors of disease; extrinsic causes of disease-inanimate, animate, biological poisons; the diffusion of disease through air, water, and soil; the method of transmission of disease by animals; conveyance of parasites by foods; social intercourse as a factor in the transmission of disease; modes of parasitic invasion, action, and elimination; immunity; artificial defences; asepsis, antisepsis, and disinfection; prevention of the transmission of disease by animals; alimentary, respiratory, cutaneous, and venereal infections, and circulatory inoculations. The information presented in the 305 pages which this part occupies is enormous in amount, and it is all solid matter, with no padding. Necessarily, there is an absence of that literary style that makes easy reading and holds the attention, but everything is clearly and, with few exceptions, correctly stated.

Part II., on Civic Hygiene, by Professor Leffmann, deals with sites and plans, streets, open spaces, roadways, street cleaning, nuisances,

offensive trades, city noises, public buildings, tenement houses, roof-gardens, sanitary authorities, hospitals, quarantine, notification, control of venereal diseases, food supply, and water supply, disposal of waste, of sewage, and of the dead. To those who are familiar with Dr. Leffmann's other work it is hardly necessary to remark that this portion is entertainingly written, and is authoritative. Dr. Albert Abrams, in Part III., on Domestic and Personal Hygiene; Nursing and Care of the Sick-room, treats fully and clearly of the hygiene of dwellings, ventilation, heating, lighting, plumbing, school hygiene, hygiene of travel, clothing, bathing, rest and recreation, and a host of important topics connected with nursing. Like the other parts of the book, this is well done and will well repay reading. Taken as a whole, the volume is an exceedingly valuable book of reference, and should have a wide sale.

CH

MEDICAL JURISPRUDENCE, INSANITY, AND TOXICOLOGY. BY HENRY C. CHAPMAN, M.D., Professor of Institutes of Medicine and Medical Jurisprudence in the Jefferson Medical College of Philadelphia. Third edition, thoroughly revised. With 64 illustrations and 4 plates in colors. Pp. vii., 329. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

This manual, based on the author's experience of six years as coroner's physician, is evidently intended to give to the student a general survey of the subject rather than to serve as an aid to experts and others interested in court practice. Necessarily, in such a brief survey, many omissions of important points must occur, and the treatment of most of the subjects must be somewhat too general to be of much value. The part devoted to toxicology is especially inadequate. The present edition is, as a whole, an improvement over its predecessors, like which it may be regarded as a perfectly safe guide to the study of more comprehensive works.

C. H.

A TEXT-BOOK OF LEGAL MEDICINE AND TOXICOLOGY. Edited by FRED-ERICK PETERSON, M.D., Chief of Clinic, Department for Nervous Diseases, Columbia University; and WALTER S. HAINES, M.D., Professor of Chemistry, Pharmacy, and Toxicology, Rush Medical College, Chicago. In two volumes. Volume I. Pp. 730. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

THE object of this work, of which this is the first volume, is, as stated in the preface, to give to the medical and legal professions a fairly comprehensive survey of forensic medicine and toxicology in moderate compass. Unlike most recent works on the subject, it is neither a résumé nor an encyclopædia, but it treats each of the several topics presented with sufficient fulness to meet the requirements of most of those whose practice calls them into court as witnesses or attorneys. All of the con-

tributors—for the work is composite—are men recognized as authorities in their respective lines of knowledge and usefulness. The introduction by the editors deals with expert evidence, and gives sound advice to medical experts and valuable suggestions to attorneys. The topics treated include the technique of medico-legal post-mortem examination; identity; the signs of death; sudden death; death from cold, heat, starvation, asphyxia; death and injuries by lightning and electricity; wounds, gunshot wounds, burns, and scalds; the destruction and attempted destruction of the human body by fire and chemicals; railway injuries; injuries and disorders of the nervous system following railway and allied accidents; the medical jurisprudence of life insurance and accident insurance; medico-legal aspects of vision and audition; speech disorders; inebriety; the stigmata of degeneration; insanity, idiocy, imbecility, and feeble-mindedness, and mental perversions of the sexual instinct. The writers include such well-known authorities as Drs. Ludvig Hektoen, James Ewing, Allen J. Smith, Ely Jelliffe, Lewis Balch, Josiah Newhall Hall, Walter S. Haines, J. Chalmers Da Costa, Pearce Bailey, S. T. Armstrong, Edward Jackson, Frank Warren Langdon, Graeme M. Hammond, Frederick Peterson and J. T. Eskridge. It will be noted that this volume does not touch on toxicology, and covers only a portion of the general subject of forensic medicine.

It would be impossible within the ordinary limits of review to do justice to the many very excellent qualities of this volume. Each chapter holds the interest of the reader throughout, and is presented with great clearness. The reviewer has no hesitation in saying that the work is one of the very best that has been produced in the English language, and reflects great credit both on the writers and the publishers. The illustrations and presswork are excellent and the index very complete.

C. H.

THE PRACTICAL MEDICINE SERIES OF YEAR BOOKS. Vol. V., "Obstetrics." Edited by Reuben Peterson, A.B., M.D., Professor of Obstetrics and Gynecology in the University of Michigan. Chicago: The Year Book Publishers.

THE present volume, one of a series issued monthly with the purpose of covering the work of the year in medicine and surgery as portrayed in the literature, is deserving, as its predecessors have been, of much praise for the manner in which it has fulfilled its mission.

The idea of this series is to present a bound volume of abstracts of the important articles which have appeared recently, thus enabling readers to obtain a view of the whole field, and placing them in a position to investigate further along special lines as their individual needs

and inclinations may prompt.

There are no comments upon the views expressed by the authors abstracted, as the editor feels that no good purpose could be obtained by such a course. This seems rather unfortunate to us, since the views of the editor would act as a corrective in certain cases; but the reason given for his abstaining is valid, since the size of the volume would not permit an expression of his opinion as regards every paper, and unless this were done he would tacitly give consent to all articles not criticised.

W. R. N.

REPORT OF STREAM'S EXAMINATION, CHEMICAL AND BACTERIOLOGICAL, OF THE WATERS BETWEEN LAKE MICHIGAN AT CHICAGO AND THE MISSISSIPPI RIVER AT ST. LOUIS FOR THE PURPOSE OF DETERMINING THEIR CONDITION AND QUALITY BEFORE AND AFTER THE OPENING OF THE DRAINAGE CHANNEL. MADE UNDER THE DIRECTIONS OF ARTHUR R. REYNOLDS, M.D., Commissioner of Health, City of Chicago. Published by authority of the Trustees of the Sanitary District of Chicago, December, 1902.

In May, 1889, the Chicago Sanitary District was created for the diversion from Lake Michigan of the sewage of Chicago and its inoffensive disposal toward the Gulf of Mexico, whereby further pollution of water along the city front would be prevented, and, incidentally, the "malaria preserves" along the Illinois River would be reclaimed, and navigation between Lake Michigan and the Mississippi River improved. The Sanitary Drainage Channel, which was constructed for these purposes at an expenditure of \$36,000,000, was opened in January, 1900, but long before it was finished the city of St. Louis had threatened to appeal to Federal authority to prohibit its use, on the ground that the sewage from Chicago would ruin the St. Louis water supply. Accordingly, Dr. Arthur R. Reynolds, the Commissioner of Health, urged upon the Board of Trustees of the Sanitary District of Chicago the desirability of an exhaustive series of examinations, both chemical and bacteriological, of the waters between Lake Michigan at Chicago and the Mississippi River at St. Louis, in order to determine their condition and quality before the completion of the channel and for comparison with their condition and quality under the dilution to be afforded by the channel. It was suggested that duplicate samples should be offered to the St. Louis authorities for examination in their own behalf, on the assumption that the opposition to the channel had an honest animus. Arrangements were made to have the examinations made at the University of Chicago, the University of Illinois, and the laboratory of the city of Chicago. The authorities of St. Louis were invited to take part in the investigation, but did not reply. The investigation was conducted by Dr. Gehrmann, of the City Laboratory; Professors Palmer and Burrill, of the University of Illinois; and Professor Jordan, of the University of Chicago, on a plan of great magnitude; and their results, which are given in great detail, make this very useful and instructive report, comprising 140 pages plus 195 full-page tables. Briefly, the result of the work is this: The charge that Chicago sewage injuriously affected the drinking water at St. Louis is completely and effectually All evidence that typhoid bacteria or other pathogenic organisms are likely to pass from Chicago to Grafton, above St. Louis, in the water of the Illinois River, was negative, and a study of the death rate among the colon bacteria added to the river water in sewage indicates that typhoid bacteria are not likely to survive passage down The colon bacilli disappear almost completely in less than 150 miles flow, and since they are more hardy than the typhoid bacillus, it is submitted by Jordan that there is every reason to believe that this organism dies out with, at least, the same rapidity. Moreover, while typhoid bacteria were found in the water at the mouth of the Illinois, there are scores of communities to which they might be traced more plausibly than to Chicago. Professor Burrill agrees that it is very clear that

Chicago sewage cannot be held responsible for contaminations existing in the commingled waters of the Mississippi and Missouri Rivers, and Professor Palmer's report is also to the same effect. The volume is one which will be read with great interest by all who are interested in water supplies and sewage disposed by water carriage.

C. H.

UEBER DAS MALIGNE CHORIONEPITHELIOM UND DIE ANALOGEN WUCH-ERUNGEN IN HODENTERATOM. By W. RISEL, Arbeitem aus dem pathologischen Institute zu Leipzig. Leipzig: Herausgegeben von F. Marchand, Hirzel, 1903.

In this monogram of 170 pages Risel presents a very complete study of "deciduoma," or, as he prefers to call it, "chorionepitheliom," and of the analogous development sometimes seen in teratomata of the testicle. The literature, comprising 131 references, is most thoroughly analyzed, and the writer's conclusions are based in part upon the results of this analysis and in part upon his own studies. Six new cases of deciduoma are described, and the result of the study of the metastases of a previously reported (Menge's) case is also given.

Of the six examples, two developed after abortion, one without metastases, the other with extensive secondary involvement of practically all organs except the spleen. The remaining four cases were associated with uterine mole. In one there was no dissemination, while two were accompanied by metastases. The fourth belonged to the interesting group in which multiple metastases are found in the absence of a primary tumor of the uterus; the mucosa of the latter, however,

being transformed into decidual tissue.

In describing the bistological character of this tumor, Risel uses the terms "typical" and "atypical," first introduced by Marchand. The former indicates a tumor in which is preserved the character of chorionic epithelium as seen in the early periods of pregnancy (symmetrical masses in irregular, multinucleated, branching processes with more or less prominently developed polyhedral decidual cells). The latter term indicates that this regular arrangement is more or less lost, the cells isolated, altered in form, and differing in their staining characteristics. The distinction, however, is not always easy, owing to the occurrence of transitory stages. Of special interest are the observations upon the development of metastases of the skin; the ready penetration of the uterine vessels by tumor processes, thus explaining the secondary growths, and the relation which the new-growth has to fibrin formation and the destruction of the invaded tissues.

Two cases are described in which after abortion and curettage an extensive development of chorionic, epithelium-like tissue occurred, with-

out, however, displaying malignant tendencies.

From an analysis of the literature and the study of two specimens, Risel comes to the conclusion that although cell formations resembling chorionic epithelium may occur in teratoma of the testicle, there is no proof that they arise from included fetal membranes. Their origin is apparently from the fetal ectoderm, and they are of the same importance as other ectodermal structures of teratomata.

The work is illustrated by two figures in the text and by three plates.

D

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND,

AND

W. S. THAYER, M.D.,

ASSOCIATE PROFESSOR OF MEDICINE IN JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND,

A Statistical Study of the Intestinal Parasites of 500 White Male Patients at the United States Government Hospital for the Insane.— GARRISON, RANSOM, and STEVENSON (Hygicnic Laboratory, Public Health and Marine Hospital Service of the United States, Bulletin No. 13) recently published the results of the examinations of the stools of 500 white patients in the Government Hospital for the Insane at Washington, with the object of determining the frequency of intestinal parasitic infection. Parasites were present in 66 (or 13.2 per cent.) of the cases. Ten patients had a double infection, and in one case three different parasites were present, making a total of 78 infections. The uncinaria americana, or anchylostoma duodenale (hook worms) was present in 15 cases, or 3 per cent.; the trichuris trichiura (whip worms) in 54 cases, or 10.8 per cent.; the oxyuris vermicularis (seat worms) in 4 cases, or 0.8 per cent.; the strongyloides stercoralis (Cochin-China worms) in 3 cases, or 0.6 per cent.; the ascaris lumbricoides (eel worms) in 2 cases, or 0.4 per cent. No tape worms, flukes, or coccidia were found. No evidence of parasitic infections of the liver, stomach, lungs, or other organs was present. The largest number of infections occurred in the men who had returned from service in the Philippines. Of 59 of these, 25, or 42.46 per cent., had intestinal parasites. There were 10 infections with hook worms, 23 with trichuris, 1 with strongyloides, and 1 with ascaris, or a total of 35 infections. The percentage of infections in these men was more than twice as high as in any other group. The writers emphasize the danger the returned Philippine soldier is to the general public, owing to the risk of spreading the uncinaria infection in districts not previously infected.

parasites apparently had but little influence on food digestion, nor did they influence the reaction of the feces.

The Occurrence of Gout in the United States.—After referring to the general belief that gout is of infrequent occurrence in the United States, and quoting several English anthorities supporting this view, FUTCHER (Practitioner, July, 1903, p. 6) proceeds to show that this belief is quite erroneous. This is done by comparing the number of cases of gout admitted to the medical wards of the Johns Hopkins Hospital for a period of fourteen years with the number admitted for the same period to St. Bartholomew's Hospital, a general hospital in Southern England, where gout is conceded to be more prevalent than anywhere else in the world. In the former institution for this period there were 41 cases of gout, or 0.26 per cent, of the total number of medical patients, while in the latter there were 124 cases of gout, or 0.37 per cent. of the medical cases. The ratio of gout admissions to the two institutions was practically two to three. In other words, the frequency of gout in a general hospital in London is only one-third greater than in a similar institution in Baltimore, and there is no reason to believe that the disease is more frequent in Maryland than elsewhere in the United States.

In the majority of the cases the disease was acquired rather than inherited. Alcohol, in the form of fermented spirits, and lead were the most potent etiological factors. All of the patients were males, and with one exception whites. Thirty-two of the patients were native-born Americans. In 39 the disease had reached the chronic stage, and in 19 tophi were present.

Arteriosclerosis was evident in 29 cases. The majority of the cases showed signs of nephritis of an interstitial type. Albumin was present in 32 and hyaline or granular casts in 26 instances. There were 4 cases of gouty bursitis, 1 of parotitis, 1 of pericarditis, and 1 of retrocedent gout, with symptoms simulating intestinal obstruction.

The difficulty of differentiating the disease from articular rheumatism in the early stages was illustrated by the fact that four of the cases were repeatedly diagnosed as the latter on their early admissions, the appearance of tophi containing characteristic acicular crystals of biurate of soda, later revealing the true nature of the disease. The series illustrated the importance of examining the ears and the vicinity of the joints for the presence of tophi in all cases of multiple arthritis of doubtful origin.

The opinion is expressed that the apparent infrequency of gout in the United States is due in large part to the failure on the part of physicians to recognize the disease.

Lipæmia in Diabetes Mellitus.—Fraser (Scottish Medical and Surgical Journal, September, 1903, p. 200) reports an instance of lipæmia in a fatal case of diabetes mellitus in a boy, aged seventeen years. The patient died of typical diabetic coma. The lipæmia was recognized several weeks before death. A microscopic examination of the blood showed the plasma to contain innumerable fine granulations, exhibiting a rapid, oscillatory, "Brownian" movement. After standing for an hour the preparation showed clear refractile droplets less than half the diameter of a red blood corpuscle. These droplets stained black with perosmic acid, and red with Soudan III.,

demonstrating their fatty nature. Ophthalmoscopic examination of the eyes showed the retinal vessels to have an opaque white color. Death was ushered in by characteristic "air hunger," and the urine contained large amounts of acetone and diacetic acid.

The heart's blood, removed at autopsy and allowed to stand, separated into a lower dark purplish-red coagulum and an upper pale reddish-brown turbid serum, at the bottom of which was a creamy white layer of fat. The cavities of the pleura, pericardium, and peritoneum, as well as the subdural space, contained a large quantity of milky fluid. The vessels on the surface of the brain contained a distinctly milky-looking fluid which evidently displaced the blood. This milky fluid was irregularly distributed. The vessels of all the organs, including the lungs, contained a similar milky fluid. Sections of the various organs stained with hæmatin, perosmic acid, and Soudan III. clearly demonstrated that this milky fluid was fat. There was no marked fatty degeneration in any of the tissues, this being most extensive in the liver.

An analysis of the blood taken from the femoral artery showed 16.44 per cent. of fat, and that of the pleural exudate 18.94 per cent. When one considers that normal blood, according to the numerous analyses of Becquerel and Rodier, contains only from 0.16 to 0.325 per cent. of fat, and the blood of ordinary uncomplicated diabetics, according to Schmidt and Röhring, only from 0.18 to 0.5 per cent., it can be appreciated what an enormous increase there was in this case. In only one instance has this high percentage of fat in the blood been exceeded. Fischer has quite recently reported a case of diabetic lipæmia in which the blood contained 18.129 per cent. of fat.

An excess of fat in the blood of diabetics was noted as early as 1799 by Mariet, of Edinburgh. Special interest was attached to its occurrence in 1879, when Sanders and Hamilton advanced their theory that diabetic coma was due to fat embolism of the cerebral and pulmonary vessels. Fraser supports the generally accepted view that fat embolism is not the cause of the coma. The writer does not think that the fat in these cases is derived from that resulting from fatty degeneration of the viscera. Nor docs he believe that it results from an accumulation of the normal fat in the blood owing to defective lipolysis. He points out the significant fact that in his case and in cases reported by other observers the appearance of coma and lipemia are coincidently, or nearly coincidently, associated with a marked reduction in the quantity of sugar in the blood and urine. He intimates that by means not yet understood the sugar may undergo transformation into fat, a physiological process illustrated by the transformation of sugar into beeswax, as pointed out by Halliburton. He further states that in accordance with the amount of this fat in the blood the solvent capacity of the serum for oxygen would become reduced, and that thereby the death-producing power of the existing acidosis would be reinforced. The writer urgcs the importance of early recognizing the existence of an acid intoxication and a lipæmia by frequent examinations of the urine and blood. While the lipæmia in itself is not a source of great danger, both are probably dependent on the same factors. He insists on the necessity of commencing the alkaline treatment early when the urine indicates the existence of an acid toxemia or acidosis.

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

JOHN RHEA BARTON PROFESSOR OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY HOSPITAL,

AND

F. D. PATTERSON, M.D.,

SURGEON TO THE X-RAY DEPARTMENT OF THE HOWARD HOSPITAL; CLINICAL ASSISTANT TO THE OUT-PATIENT SURGICAL DEPARTMENT OF THE JEFFERSON HOSPITAL.

Clinical Remarks on the Results of Operations for Strangulated Hernia.—Barker (Lancet, May 30, 1903) reports the results of an analytical study of 406 consecutive cases, treated in the University College Hospital. London. It is of interest to note that the number of cases operated on for strangulated hernia in this hospital has gone on steadily rising, and for the last ten years the average number has been just twice as great as twenty years ago. This is partly due to the fact that reduction by taxis is now less frequently resorted to in severe cases than formerly, but not entirely. As to the diminution in the number of cases admitted into the wards for strangulation and there treated by taxis, it may be stated that in the first series of years taken 36 were so treated by taxis, in the second equal number of years 52, in the third only 19, in the fourth only 6, and in the last none at all. But though strangulated hernia may possibly not decrease in frequency there is happily every prospect that the ill effects which result from it may diminish in severity as its dangers are more fully recognized and more intelligent and common-sense measures are adopted to meet them at an early moment. This condition is common to all classes as well as being found in all classes. The mortality in the cases treated by taxis has been so high (13.8 per cent. in the first series and 13.4 per cent. in the second equal series) that there is grave doubt whether, in any given case of strangulated hernia, taxis ought ever to be employed except in the very recent cases and among aged patients in a state of great weakness. The actual duration of the strangulation has been shown to be an unsafe guide as regards the propriety of replacing the loop in the abdomen.

Leaving quite apart the cases in which taxis has been applied, the cases that have required operation show a very high rate of mortality, and this in spite of all our improvements in surgical theory and procedure. Of the 406 cases 127 died, or a mortality of 31.2 per cent.; but when this is further analyzed the result is better than at first appears, for in the first series of years the mortality was 53.1 per cent., while in the last series it is only 22.2 per cent. A careful consideration of the mortality table shows that about 100 of these cases died from trouble depending upon the state of the bowel returned. In other words, if it had been possible to treat these cases without returning the gut there would probably have been a much lower death rate. During 1903 seven cases of this character were treated by enterectomy, with

four deaths, and it is quite sure that each of these patients who recovered would undoubtedly have died had the bowel been returned to the abdomen in the condition in which it was found. Along these lines lies the hope for a further reduction in the mortality of operation for the relief of strangulated hernia.

Some Observations on Movable Kidney.—Gordon (Lancet, June 6, 1903) states that it is now well recognized that movable kidney is a cause of various and diverse symptoms—that it may induce vomiting and other gastric manifestations, jaundice and hepatic colic, or symptoms which belong to the kidney itself, and that it may be associated with a neurasthenic condition. With such diversity of symptoms, it can readily be understood that movable kidney is a common cause of mistaken diagnosis. There are two facts which, when fully realized, ought to safeguard one against error to some extent. First, it should be remembered that movable kidney is of exceedingly common occurrence and often is the sole cause of some of the symptoms which have been mentioned. In the second place it should still more carefully be borne in mind that the movable kidney, whatever degree of mobility it may possess, may be a cause of no symptoms. One may conveniently arrange these cases which cause symptoms into certain groups as follows: (1) Those with slight discomfort, such as dragging sensation and associated with vague general ill health, with or without hysterical manifestations. (2) Those in which the symptoms are of the gastrointestinal type. (3) Those with hepatic symptoms. (4) Those having distinctly renal symptoms, which must be very uncommon. The author, after reporting in detail seven eases illustrating these groups, states, in conclusion: (1) That in neurasthenic cases nephropexy may do good. (2) Vomiting and other gastric symptoms can certainly be cured, but if dilatation of the stomach is present a guarded prognosis must be given. (3) Movable kidney is not the only cause of obscure abdominal symptoms, as has been shown in a case of mistaken diagnosis. (4) Movable kidney occasionally causes symptoms which exactly simulate those due to gallstones, but seeing that the coincidence of movable kidney and gallstones is not uncommon, it would be unwise mercly to fix the kidney without a preliminary examination of the gall-bladder and ducts. Finally, whilst readily granting that most cases of movable kidney cause no symptoms, and therefore require no operation, there remain many which do cause symptoms, and in a fair proportion of these an excellent result from nephropexy may confidently be anticipated.

The Treatment of Enlarged Prostate.—Heaton (Birmingham Medical Review, June, 1903) states that Sir Henry Thompson has estimated, from a large number of post-mentem examinations made on male adults over the age of sixty, that the prostate was enlarged in 34 per cent of such patients, but that it did not cause symptoms during life in more than 15 or 16 per cent. The main indications for operation may be stated as follows: (1) When, after a longer or shorter period of catheter life, the difficulty in the passages of the instrument is becoming greater and greater, and its use is becoming necessary at shorter and shorter intervals. (2) When the enlargement of the gland, as determined by examination per rectum and by means

of the cystoseope, is chiefly an enlargement of the middle lobe, producing a valvular obstruction to the outflow of urine. (3) When the bladder has been opened for complete retention, and the patient's condition is sufficiently good to give him a reasonable chance of standing the major operation. (4) When enlarged prostate complicates vesical calculus. (5) When the patient's strength is being undermined by want of sleep and pain from repeated catheterization, or when the introduction of the catheter is always followed by hemorrhage. (6) After repeated attacks of acute inflammation of the enlarged organ.

Treatment. Double eastration was introduced to the profession by Dr. J. William White in 1893. As compared with the operations of complete or partial prostatectomy it seems to have the following advantages: (1) That of a considerably lower mortality. The mortality of double castration, when performed upon patients who are not actually in extremis, is probably not more than 8 or 9 per cent. (2) The operation is speedicr, accompanied by less shock and less reflex effect on the kidneys if they are already diseased. (3) There is practically no risk of hemorrhage; whereas, in the operation of prostatectomy the hemorrhage may be most severe, and, indeed, be indirectly the cause of the patient's death. (4) The period of confinement to bed and convalescence is much shorter. The objections to the operation are the sentimental objection upon the part of the patient to the loss of the organs. The removal of both testicles does not seem to produce the same effect upon all enlarged prostates. When the enlargement is a pure hypertrophy, or contains a good proportion of glandular element in it, the diminution in size is generally marked and more often rapid. But if the enlargement be more fibrous, and the gland be cleaner and harder than normal, the diminution less marked. Rarely cerebral complications have been known to follow this operation. If the inability to empty the bladder be due to muscular atony of its wall, little or no benefit will accrue from any radical operation.

The author reports five eases treated by this method, all of which were improved by the operation. As regards the statistics of this operation White, in 1895, collected 111 eases, with a mortality of 18 per cent. In 87 per cent. of those that recovered there was more or less atrophy of the prostate, and in 46 per cent. the local conditions became almost normal, while the more troublesome symptoms returned in 13 per cent. Wood has collected 159 cases with 13 deaths, and in 16 the result is not stated. Of the remaining 130 cases the prostate decreased in size in 51.5 per cent., and in 57 per cent. the function of micturition was either improved or wholly restored.

Vaseetomy has been urged as a substitute for eastration, and Harrison has reported a series of 100 cases where some benefit apparently followed in every ease. Wood has made an analysis of 193 eases and found the death rate to be 6.7 per cent. Of the cases that recovered from the operation there was some improvement in 15 per cent., and residual urine diminished or disappeared in 5 per cent., but in 15 per cent. no improvement whatsoever followed. It would, therefore, seem that the operation has nothing to commend it as a substitute for castration save its lower mortality, and its results are too uncertain at present to justify us in advising our patients to undergo it, save when castration is objected to.

Suprapubic prostatectomy. Freyer has published the results of 21 operations by this method, with 2 deaths. In the other 19 cases a good result was obtained.

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD WEBB WILCOX, M.D., LL.D.,

PROFESSOR OF MEDICINE AND THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL,

AND

SMITH ELY JELLIFFE, M.D., PH.D.,

PROFESSOR OF PHARMACOGNOSY AT THE COLLEGE OF PHARMACY; INSTRUCTOR IN MATERIA MEDICA AND THERAPEUTICS (COLUMBIA UNIVERSITY), NEW YORK.

A New Tetanus Treatment.—Dr. J. MacFarland, of Philadelphia (Journal of the American Medical Association, 1903, vol. xli., No. 1, p. 34), describes a dry antitetanic powder suggested by Prof. Calmette at Lille. This observer showed that antitetanic serum is readily absorbed by denuded surfaces, and thus taken in can confer immunity on animals. MacFarland then combined a harmless antiseptic with a dry antitetanic serum, resulting in an antitetanic powder. This antitetanic powder demonstrated that it could confer immunity on susceptible animals.

X-ray Therapy in Enteritis and Colitis.—Dr. Sinclair Tousey (New York Medical Journal, July, 1903, vol. lxxviii., No. 2, p. 73) has been making some experiments on the treatment of chronic conditions of pain or discomfort in the intestines, with frequent discharge of mucus and occasionally discharges of blood and false membrane, and which have failed to yield to the use of intestinal antiseptics given by mouth and to other antiseptics given by enteroclysis. He has made applications by having the patient lie flat on an examining table, exposed, and with an X-ray tube about eight inches from the surface, and the light directed principally toward the region where the pain is felt. The first exposure lasts from three to five minutes; later the exposures may be greatly increased in duration. The improvement in the few cases which have come under treatment, he says, may be due to the novelty of the procedure. Any expectation of lasting benefit may be interpreted along the lines of the well-known stimulating and alterative effect of the X-ray upon the tissues rather than to its bactericidal action.

The Nernst Lamp in Therapeutics.—Dr. WM. RAWLINS, of Boston (Boston Medical and Surgical Journal, 1903, vol. cxlix., No. 2, p. 37), suggests the use of the Nernst lamp instead of other forms of electrical apparatus now used in light therapeutics. He says that the ether wave is extremely short, and that there is no glass covering and there is no absorption. He says the light is well suited for use in therapeutic cabinets in which an even distri-

bution of radiant energy is desired, and heretofore obtained by using many incandescent bulbs. Another advantage he holds is that the consumption of current for the same number of light waves is greater, less of the current being converted into heat waves.

Cause and Treatment of Gout .- Dr. ALEXANDER HAIG (Practitioner, July, 1903) presents some modifications of his uric acid theory as to the causation of gout, coming to the following conclusions: (1) That gout is due to poisoning by flesh and tea and similar substances, which introduce uric acid into the body in very considerable quantities. (2) That the uric acid so introduced may not only remain in the body, but may prevent the excretion of the uric acid formed in the body. (3) That as a result the tissues of the body become more or less saturated with uric acid, which may irritate its fibrous tissues (gout or rheumatism), or may obstruct its capillaries, causing high blood pressure and defective capillary circulation and their results, such as the great group of circulation diseases, the uric acid headache, epilcpsy and mental disease, anemia, Bright's disease, Raynaud's disease, etc.all of them being mere results of the enormous influence which uric acid exerts on the circulation of the body by obstructing its capillaries. all these troubles which have been called by so many names fall into two groups—(a) the local group and (b) the circulation group—of which the latter is by far the more extensive and important, so that what we formerly called gout and rheumatism become almost insignificant by comparison. the future they will all, he hopes, be called uric acid poisoning, and be recognized as due to poisonous or unnatural food.

So far as treatment is concerned, he says "that in acute cases with fever the indication is to give a solvent, and that the best solvent is a salicylate. either in the form of salicylate of soda or salicylic acid, or, perhaps better than either, aspirin; and to give this in sufficient quantity, not less than a drachm a day, and often more than this, up to the ordinary doses given in acute rheumatism. In chronic arthritis without fever, but without debility, the same drugs may be given, although care must be taken to feed up, to give a certain amount of acid, to keep the patient cool, and to give some tonics. In very chronic arthritis, with marked debility and anemia, the first thing to do is to give tonics and to feed up on any food without the least regard to uric acid; and when the patient has been got into a condition of good nutrition by these means, salicylates in one of the above forms may be given with advantage. Where there is marked debility with acidity of the urine, they should certainly not be given at first; and, as he has pointed out, many of these cases of arthritis with debility improve very greatly by feeding up and tonics, because these clear the blood of floating uric acid, and thus put a stop to the "uric acid filter" action, which was the cause of the chronic trouble. In these conditions, associated with debility, drugs that put a stop to collemia may produce a more or less acute arthritis as they clear up the collemia. If they do this, and if there is with the arthritis a rise of temperature, then it would be right to treat the arthritis with salicylates, just as in the cases which are acute from the beginning. But it is a very interesting experience to watch the effect of giving, say, a metal which forms an absolute compound with uric acid and drives it out of the blood

into the fibrous tissues or joints, producing the whole series of changes above described in the blood and circulation and in the urine, which may be easily observed as they pass before you. The patient will then say that he has had a relapse of his gout, and one will know why he has had it, and also exactly what it is necessary to do to prevent all future similar relapses.

The many errors and misunderstandings that have arisen as to the etiology and pathology of arthritis and collemia, or the local group and the circulatory group of uric acid poisonings, have for the most part been due to the original errors and erroneous conclusions of those physiologists and experimenters who worked without any regard to the solubility of uric acid in the blood and tissue fluids of the body. If these experiments had never been made it would have been seen much more quickly, what is known to-day, that these things are not diseases at all, but mere symptoms of food poisoning, and that the poisons being left out the symptoms cease to appear.

When this has become common knowledge it will be obvious that the "uric acid diathesis" is a myth, and that gout is but a symptom of poisoning by flesh and tea; while, lastly, this complete and correct knowledge will give complete power over the symptoms, and enable the removal of all results except the larger structural lesions which the food poisons may have produced.

Injections of Calomel.—Dr. M. Danlos (Les nouveaux remédes, 1903, vol. xix., No. 9, p. 103) presents a note on two modifications of the usual formulæ for the injection of calomel that he has found useful in the treatment of rebellious cases of tertiary syphilis. It has been found by many syphilographers that these obstinate cases of tertiary syphilis have been greatly benefited by injections of calomel, but occasionally there are patients who resist even this remedy when used in the old form. The use of oily vehicles to suspend the calomel is open to much criticism. Vaselin, which is largely used, dissolves calomel very slowly and favors the formation of nodes, which engulf the salt and prevent its action. Water does not hold calomel in sus-Emboli are apt to form, and, moreover, portions of the drug remain in the syringe. Glycerin, gum, and syrup have been used. Glycerin, however, has been found to be painful, and the gums are difficult to sterilize. The author has made some experiments with the use of sugar, which vehicle he has found of great service. The sugar and the calomel are sterilized separately. The mixture is made in a sterile flask, and injections are made with this sterilized product.

New Salts of Mercury for Injections.—Drs. L. Jullien and F. Berlioz (Les nouveaux remédes, 1903, vol. x., No. 10, p. 223) have obtained and have studied several new soluble salts of mercury for the treatment of syphilis. They have combined a cacodylate of ammonium with an oxide of mercury, forming a mercurial cacodylate, which results in a gray powder very soluble in water, containing at least 56 parts of mercury in 100. In tests on at least fifty patients a dose of $\frac{1}{5}$ to $\frac{1}{5}$ of a grain has been very well borne. Another salt, the ammonium-chloro-mercurate, is made by dissolving the yellow oxide in the solution of ammonium chloride. This seems to be better borne than corrosive sublimate, although it has been found at times that injections are painful. The dose is the same as sublimate.

OBSTETRICS.

UNDER THE CHARGE OF

EDWARD P. DAVIS, A.M., M.D.,

PROFESSOR OF OBSTETRICS IN THE JEFFERSON MEDICAL COLLEGE; PROFESSOR OF OBSTETRICS AND DISEASES OF INFANCY IN THE PHILADELPHIA POLYCLINIC; CLINICAL PROFESSOR OF DISEASES OF CHILDREN IN THE WOMAN'S MEDICAL COLLEGE; VISITING OBSTETRICIAN TO THE PHILADELPHIA HOSPITAL, ETC.

Tubal Gestation.—In the Scottish Medical Journal of April, 1903, KYNOCH reports the case of a patient whose menstruation had been delayed one week, followed by a continuous hemorrhagic discharge. She had passed two large pieces of membrane. The uterus was movable and slightly enlarged. Posteriorly and to the right of the uterus there was a fixed tender swelling about the size of a finger. After four weeks, during which the patient had intermittent pain and hemorrhage, operation was performed. The right Fallopian tube was distended and both were adherent. The tube contained a sac with villi. Eighteen months previously this patient had symptoms of ectopic gestation on the opposite side, ending in the formation of a hæmatoma of the left broad ligament.

Case II. was a multipara who had suffered from ovaritis on the left side. Menstruation was delayed for six weeks, and she had had much pelvic pain. There had been an abundant red discharge. On examination, the nterus was slightly enlarged, with tenderness on both sides, and to the right and behind an enlargement of the size of the finger. Upon operation the right Fallopian tube, which was enlarged and adherent, and the ovary were removed. On opening the tube it contained a blood clot with a cavity lined with a smooth membrane containing a reddish fluid. There was no trace of embryo.

His third case complained of pain on the right side, with an enlarged uterus and a tender swelling to the right and behind it. On examination under an anæsthetic something was felt to give way under pressure. The patient had shock and showed signs of hemorrhage. When the abdomen was opened a large quantity of blood was present and a rupture in the right tube. The tube and ovary were removed, the abdominal cavity irrigated, and strychnine was given. The tube was filled with blood clot containing a sac, whose walls showed villi. No embryo was found.

He also reports a case in which he suspected tubal gestation, but which proved to be a threatened abortion. The patient discharged twin ova soon after examination.

Kynoch also reports the case of a patient from whom he had removed an ovarian cyst upon the right side. After menstruation had been absent for two months the patient complained of pain. There was a round, tender swelling about the size of an egg behind the nterns. On opening the abdomen the left tube was found to be thickened and the ovary adherent. Both were removed. The ovary consisted of a small cyst filled with dark, tarry blood. The tubal swelling was found to be tuberculous. In this case hemorrhage into a cystic follicle caused pain resembling that of ruptured ectopic gestation.

Hydrosalpinx and cystic ovary may simulate tubal gestation, as illustrated by the following case: The patient complained of intermittent pain in the right iliac region. On examination a tender oval swelling was found on the right side and separated from the uterus. At operation the swelling was found to be a cystic ovary adherent to the tube.

Puerperal Insanity.—Jones (Transactions of the Obstetrical Society of London, 1903, part i., vol. lxv.) contributes an extensive paper, giving the results of his experiences in 259 cases of puerperal insanity, of which 120 were during the puerperal period, 83 during lactation, and 56 during pregnancy.

From these cases he concludes that the insanity of pregnancy is more common where the pregnancy is illegitimate and in the first confinement. Acute melancholia with suicidal symptoms was present in 41 per cent, of these cases. During the early months insanity is less acute than when the patient becomes insane just before her labor. The sex of the child has no influence upon the occurrence of insanity.

Puerperal insanity occurs after the first confinement in 33 per cent, and usually develops suddenly. During lactation the symptoms are those of general physical exhaustion, with great depression. It has a tendency to become chronic. Low forms of inflammation, thrombosis, gangrene, and phthisis are seen during the insanity of lactation. Suicidal and infanticidal tendencies are also common where insanity began more than six weeks after labor.

Early symptoms are loss of sleep and headache, which should give warning of mental breakdown. Delirium with hallucination, ending in restless mania, is characteristic of this variety.

Heredity is more pronounced in the maternal line in purporal and lactational insanity, and is equally pronounced in the insanity of pregnancy. A history of previous hysteria is often given.

The pathology is that of heredity and stress. It is possible that a toxin is present where stress is the important factor.

As regards prognosis, cases of insanity during early pregnancy improve as confinement approaches, whereas those of late pregnancy grow worse during the puerperal state. Recovery often ensues and improvement is often rapid, recovery being complete in from four to five months.

All cases presenting headache and sleeplessness must have absolute rest, and quiet and sleep must be procured. If possible patients should be kept at home, and suicidal and infanticidal impulses must be guarded against. The presence of the patient's husband aggravates the symptoms. The dict should be liberal and stimulating, and change of air and scene is necessary when cases tend to become stuporose. Menstruation is a sign of mental improvement. So far as drugs are concerned iron and purgatives are valuable.

So far as the frequency of childbearing insanity is concerned, statistics show that among private patients about 7 per cent. of those women insane become so during the childbearing period; while among ward patients the percentage rises to 8 or 10. It is estimated that one case of insanity occurs for each 1100 births. Other authorities state that the ratio may vary from 1 in 400 to 1 in 700.

GYNECOLOGY.

UNDER THE CHARGE OF HENRY C. COE, M.D., OF NEW YORK.

ASSISTED BY

WILLIAM E. STUDDIFORD, M.D.

Sterility Due to the Male.—Balin (Zentralblatt f. Gynäkologie, 1903, No. 26) examined the semen of the husband in 200 cases of sterility in which no cause could be found in the wife. His conclusions were as follows: (1) In 36.5 per cent. there was azoöspermia, and in 19 per cent. oligonekrozoöspermia. (2) Of the cases of azoöspermia, 63.3 per cent. were due to gonorrhea acquired before marriage. (3) In over one-half of the cases the husband was suffering from the disease at the time of marriage. (4) Latent or manifest gonorrhea is the most frequent cause of sterility.

Gastric Disturbances Due to Pelvic Lesions.—Liopet (Lyons Thesis; abstract in Zentralblatt f. Gynäkologie, 1903, No. 26) affirms that statistics show that over 90 per cent. of women with pelvic trouble suffer from gastric disturbances. The cause is either reflex or mechanical, the latter being due to adhesion of the omentum to the inflamed uterus and adnexa, thus causing traction on the greater curvature of the stomach, gastroptosis, and even a bend of the duodenum. The first class of cases is to be treated on general principles, the latter by laparotomy and separation of the adhesions. Drainage should, of course, be avoided.

Adenomyoma of the Uterus.—FÜTH (Zentralblatt f. Gynäkologie, 1903, No. 21) reports at length the case of a virgin, aged thirty-four years, who entered the hospital with a tumor the size of the fist, which grew from the lower uterine segment posteriorly and perforated the vaginal fornix, where it appeared as an ulcerating mass, bleeding easily. The diagnosis of cancer was made, and the uterus and upper part of the vagina were extirpated by the abdominal route. Although the broad ligaments were infiltrated, the adnexa and pelvic glands were not involved. On account of the firm attachment of the neoplasm to the rectum, portions were left behind on the wall of the gut. The patient made a good recovery and was free from recurrence nine months after operation.

Microscopically the tumor showed a myomatous tissue filled with glandular structures. No invasion of the uterine or vaginal mucosa was noted. In one ovary, which was adherent to the mass, the same glandular ingrowths were found. The writer infers that the glandular element was derived from Müller's ducts. He discusses the question of malignancy, referring to cases in which Recklinghausen, Rolly and others found a transition to adenocarcinoma, and suggests the name myoadenoma malignum as appropriate for his own case.

Sarcoma of the Uterus in a Child.—Bluhm (Archiv f. Gynäkologie, Band lxviii., Heft 2) reports an interesting case of sarcoma of the cervix uteri in a child, aged eleven years, the only symptom being an occasional slight bloody discharge from the vagina, so that no examination was made for nine months. Vaginal hysterectomy was successfully performed, after making an incision according to Schuchardt's suggestion. The patient made a good recovery, and had no recurrence two months later, though the inguinal glands were enlarged at the time of the operation. The writer argues from this case that, while there are serious objections to making vaginal examinations in children, the persistence of bleeding from the genitals without a history of trauma should at once awaken suspicions of the presence of sarcoma and lead to a careful investigation. Narcosis and, if necessary, incision of the vagina are justifiable. Every cervical polypus in a child should be examined microscopically, since the importance of an early radical operation in sarcoma is self-eyident.

Gauze Pad in Peritoneal Cavity.—KAYSER (Archiv f. Gynäkologie, Band lxviii., Heft 2) reports a case in which, after removing a piece of gauze which had remained in the cavity for two months, he was obliged to resect the intestine in three places, the patient eventually making a perfect recovery. The writer reports 17 cases in which gauze was left after operation, only one of which terminated fatally. In 9 the foreign body was discharged spontaneously, in 8 removed by operation, but in none were such extensive lesions found as in the case reported.

The writer believes that, although the dangers to be apprehended from the presence of an aseptic pad are much less than those due to other foreign bodies, an attempt should always be made to remove them instead of waiting for nature to expel them, as Boldt advises. (To this list may be added the three cases reported by us, in which pads were removed through the abdominal wound.—H. C. C.)

The Function of the Corpus Luteum.—FRAENKEL (Archiv f. Gynäkologie, Band lxviii., Heft 2), from a series of observations at the operating-table and experiments on animals, concludes that menstruation depends directly upon the secretory activity of the corpus luteum, and not upon the pressure of the ripe follicle upon the nerves of the ovary. The corpus luteum is really a gland, secreting a substance which supplies to the uterus the nourishment necessary to preserve its functional activity, and also helps to diminish the climacteric disturbances which are so marked in women whose ovaries have been removed. Hence the importance of preserving the corpus luteum of pregnancy, and of performing ovariotomy only when absolutely necessary and after the fourth month. The writer having inferred that the corpus luteum must contain the active agent, was led to administer the dried substance from non-gravid cows, which he calls "lutein," in doses of four and one-half grains, repeated thrice daily. The indication in a series of fifteen cases were dysmenorrhœa and climacteric phenomena in which flushing, headache, and palpitation were prominent. These were relieved in each instance without any unpleasant effects being noted.

The writer recommends this remedy as being not only superior to oöphoriu, but much cheaper.

PEDIATRICS.

UNDER THE CHARGE OF LOUIS STARR, M.D., OF PHILADELPHIA,

AND

THOMPSON S. WESTCOTT, M.D., of Philadelphia.

A Mechanical Treatment of Whooping-Cough.—JACOB SOBEL (Archives of Pediatrics, June, 1903, p. 448) calls attention to a method of controlling the paroxysm of whooping-cough, which was first suggested by NAEGELI (Correspondenzblatt f. Schweizer Aerzte, 1889, Band xix., S. 417). It consists in pressing forward the lower jaw as is done in anæsthetization. He reports the results of his trial of this method in ninety-six cases, ranging in age from three months to eight years. No selection of cases was made, the children being taken as they came; all grades of severity and all stages were observed. Of this entire number but nine failures were recorded—that is, nine in which the method had absolutely no effect on the paroxysm at the times of the child's visit to the dispensary. In the remainder there never was a time when the reporter could not control the paroxysm and the oncoming whoop by pulling the lower jaw downward and forward. In infants and young children the method seemed less efficacious than in the older ones; they were more easily frightened, and thus the severity of the paroxysm was increased or another precipitated. In some young children, however, it acted remarkably well. In two cases of the series severe epistaxis would occur during a paroxysm; in these the method acted well and the bleeding was controlled.

According to Naegeli this manœuvre is performed somewhat differently according as the operator stands in front or behind the patient. When in front he placed the index and middle fingers on the rami in front of the ear, the thumbs on the chin, and with a forcible but gentle pull and pressure he pushed the lower jaw downward and forward. If the mouth was opened and the tongue extended he placed the thumb or index fingers in the region of the canines, the remaining fingers on the body of the lower jaw, and thus pulled downward and forward. Very frequently he placed only the thumb or index finger back of the lower incisors, the remaining fingers of that hand under the chin, and then manipulated the lower jaw, keeping the other hand on the forehead for counterpressure.

When behind the patient he placed both thumbs against the angles of the jaw, the index fingers on the zygomatic arch, the remaining fingers on the chin, and thus pushed downward and forward; or the index fingers were placed in the mouth behind the canines, and thus aided in the manipulation. When the lower jaw had been raised the patients were directed to take a deep breath (older children).

Sobel has found that a single method answers every purpose. When in front of the child he places the flexed index and middle fingers against the

angle of the inferior maxilla, the thumbs beside the nose, and then pulls downward and forward. If behind the child he places the flexed index and middle fingers against the angle of the jaw, the thumb along its body, the remaining fingers beneath it, and thus manipulates by pulling downward and forward. Naegeli stated that with this treatment the disease assumed a milder character, there was no vomiting, bleeding, or complications due to increased blood pressure, the course of the disease was shortened, and the nights were not disturbed.

Naegeli considered the effect of this manipulation due, first, to reflex action, producing a relaxation of the tonic muscular contraction, and, secondly, to mechanical action, which, by raising the entire larynx and the hyoid bone, elevates the epiglottis, and perhaps opens the rima glottidis. The only contraindication to the use of this method is the presence of food in the mouth or esophagus.

Sobel thinks it advisable to try this manœuvre in other spasmodic coughs and laryngeal spasms (laryngismus stridulus, pressure of enlarged cervical and bronchial glands, influenza, and glottic spasm in catarrhal laryngitis), though his experience has seemed to show that it is far less efficacious in these conditions than in whooping-cough.

A Contribution to the Study of the Summer Diarrheas of Infancy.—
J. H. MASON KNOX (Journal of the American Medical Association, July 18, 1903) gives the results of his investigations in a series of cases of infantile diarrhea treated at the Thomas Wilson Sanitarium, near Baltimore. Special note is made of the bacteriological findings from the stools, this work having been done by Duval and Bassett. From the stools of forty-two of fifty-three patients, mostly under one year of age, the B. dysenteriæ (Shiga) was isolated.

These were selected cases, in which the stools contained considerable mucus and blood; but later in the summer the stools of twenty-five consecutive cases were carefully examined and the B. dysenterize found in nineteen instances. All these latter cases exhibited some form of intestinal disorder.

In order to determine the presence or absence of the bacillus in normal stools the discharges of twenty-five babies, ranging in age from seven weeks to two years, suffering from no intestinal derangement, were subjected to a careful examination. In none of these cases was the Shiga bacillus found.

The technique employed in isolating the organism was essentially that used by Dr. Flexner in the Philippines. The bacilli were studied culturally on the various media, and their agglutination reaction tested with serum from the same patient, the sera from other patients, and with anti-dysenteric serum.

This agglutinating action of the blood serum for the specific organism was a great assistance in the successful isolation, but the technique requires more than usual skill, as far wider variations in the amount of agglutinin in the sera from various patients seem to pertain than in the case of typhoid fever.

The value of the agglutination reaction clinically cannot be asserted as yet positively. The author was able to obtain ten positive results from thirteen cases tested during the first week of illness. As the reaction persists in the chronic cases for weeks or months, it is in this class of cases that the blood tests may prove useful.

In several cases of the series a diagnosis was made on the basis of a positive blood reaction, and a dysentery bacillus was afterward isolated from the stools.

The importance of the finding of this bacillus is evident, as it brings a series of diarrheal cases in infants into relationship with an organism that is the proven exciting cause of certain varieties of severe intestinal disease in adults.

A detailed account of the series from a clinical aspect is given, and with it the notes of several cases.

In symptomatology and pathology the series differed in no way from the ordinary "summer diarrheas," and there was nothing to suggest that the cases belonged to an isolated group.

In regard to the method of propagation, the milk served these patients was probably the source of infection, but as the dysentery organism is related hiologically to the colon hacillus and the typhoid bacillus, which are usually conveyed to man through water, that very general source of infection must also be suspected.

The majority of the cases of the series were given unboiled city water, and of particular interest were four infants ill with this specific diarrhæa, exclusively breast-fed, but to whom unboiled water was given between nursings.

The author draws the following conclusions:

- 1. The diarrheal disorders of a large series of children treated in the Thomas Wilson Sanitarium during the summer of 1902 were produced by a bacillus thought to be identical with the B. dysenteriæ (Shiga).
- 2. The cases in this series presented the clinical and pathological features of the several forms of the summer diarrheas of infancy.
- 3. There is good reason for the confidence that a proportion, and probably a large one, of the so-called summer diarrheas of infancy is caused by the B. dysenteriæ (Shiga).
- 4. A confirmation of the work of Duval and Bassett, by establishing the etiology of this yearly epidemic among infants, will make possible the use of more intelligent measures to control and suppress it.
- 5. More success can be expected from prophylactic measures and from medicinal and serumtherapy than ever before.

The Leucocytosis of Measles and of Rubella.—Plantenga (Arch. de Méd. des Enfants, 1903, vol. vi. p. 129) has examined the blood in thirteen cases of measles and in nine cases of rubella, and concludes that the leucocyte formula is the same in the various stages of these two diseases.

During incubation there is a decided hyperleucocytosis of the neutrophile polynuclear leucocytes. This is followed during the exanthem by a very marked hypoleucocytosis of these same elements, which, in certain cases, is accompanied by a lymphocytosis at the same time that one finds a general adenopathy of the lymphatic ganglia. After the exanthem the number of leucocytes, if the case is uncomplicated, returns to normal.

In the author's opinion these results confirm the older view that measles and rubella are not two distinct diseases. One can admit, he argues, that the differences in the clinical appearance of these two eruptive fevers are due to different degrees in the virulence of the germs, or to a difference in the port of entry of the infection in the two cases.

[In the light of our present knowledge of the clinical differentiation between measles and rubella, this conclusion, based solely on a similarity of blood reactions in the two diseases, illustrates the danger of too much hæmatology.—ED.].

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

SIMON FLEXNER, M.D.,
DIBECTOR OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK,

ASSISTED BY

WARFIELD T. LONGCOPE, M.D., RESIDENT PATHOLOGIST, PENNSYLVANIA HOSPITAL.

Experimental Fat Necrosis.—Wells (Journal of Medical Research, 1903, vol. iv. page 70) has found that fat necrosis can be produced with constancy, especially in cats and dogs, by intraperitoneal injections of extracts of hog's pancreas or of ordinary commercial pancreatin. Such extracts, moreover, are active either in weak acids, alkalies, or in water. Preparations of carica papaya, or of simple alkaline solutions, did not produce fat necrosis. When the pancreatin was heated for five minutes at temperatures between 65° and 70° C, the power to produce fat necrosis was much reduced, and above 71° C. it was entirely destroyed. These observations pointed to enzyme action as a source of the condition. The exact pancreatic enzyme, which was the cause of the fat necrosis, could not itself be isolated. It was found, however, that trypsin, weak in or devoid of lipase, did not produce this condition, and that, likewise, lipolytic extracts of hog's liver and cat's serum were entirely inactive. Moreover, negative results were obtained with a mixture of pancreatic trypsin and lipolytic extracts of liver. It was not possible to obtain pure pancreatic lipase, so that the action of this enzyme alone could not be studied. Extracts of fresh dog's pancreas, however, which possessed lipolytic power, but which were almost devoid of tryptic power when injected, caused definite fat necrosis; but if to such extracts an emulsion of duodenal mucosa were added, by which means the tryptic activity is greatly increased, no fat necrosis occurred. Thus it appeared that as the pancreatic extracts lost their lipolytic action, their power to produce fat necrosis also diminished; and the author believes it highly probable that the lipase is in some way highly essential to this particular property of the pancreatic extracts. Besides the *intravitam* experiments, many of the features of fat necrosis could be produced with pancreatin in animals after death, and also in vitro. The dissemination of the fat necrosis outside the abdominal cavity was sometimes observed as early as twelve hours after intraperitoneal injections, and it was thought that through the lymphatics this spreading was accomplished. From a study of the progressive changes

which took place during the production of fat necrosis it was found that the first alteration consisted in death of the fat cells, while not until later did the fat-splitting occur and the formation of crystalline products appear. The author concludes, therefore, that the fat-splitting is subsequent to and not the cause of the necrosis. The fat necrosis proceeded but for a very few hours at any one point, for the extension seemed to be limited by a zone of leucocytes, the ultimate function of which appeared to be the absorption of the products formed.

Finally, the mere presence of fat necrosis did not seem to be detrimental to the lives of the animals, and healing was possible by a proliferation of the connective tissue from the margins of the areas.—W. T. L.

A Contribution to the Pathology of Balantidium (Paramæcium) Coli.-KLIMENKO (Beiträge zur Path. Anat. u zur Allg. Path., 1903, Bd. xxxiii. p. 281) discusses this subject and describes a case of fatal infection by the balantidium coli. The patient suffered with severe diarrhea, followed by anæmia. Blood and mucus were constantly present in the stools. frequently enclosing red blood cells, were, on several occasions, found in the freshly-evacuated feces. At autopsy the mucous membrane of the colon proved to be greatly swollen and congested, while a large amount of mucus covered it. Several ulcers, sometimes reaching to the muscular coat, were seen in the large intestine. Microscopically there was an acute inflammation of the mucous and submucous coats, with small areas of necrosis and hemorrhage in these situations. The infusoria were found, in great abundance, distributed through practically all of the coats of the intestinal wall, but were most numerous in the mucosa and submucosa. The author concludes that the balantidium coli must be regarded as the cause of certain diarrheas. At first the organisms by their motion produce a diarrhea from a mechanical irritation of the mucosa. Whether they are still motile after penetrating the wall of the colon is doubtful.

Finally, they give rise anatomically to a catarrhal or ulcerative colitis, but it is as yet uncertain whether the parasites alone are answerable for all the intestinal changes, or whether the schizomyces, also, have some part in the process. It is very probable that the balantidium reproduces in the intestinal wall. Since the infusoria may gain entrance into the bloodvessels, it is not improbable that they form emboli in the various organs, and especially in the liver and lungs. It cannot as yet be determined whether they produce the anatomical lesions principally through their mechanical action or through a chemical irritation.—W. T. L.

Further Observations on the Reaction of Bacillus Pestis in Plague.—Row (British Medical Journal, 1903, No. 2210, p. 1076) has investigated the factors concerned in the bacteriolytic properties of blood serum from convalescent plague patients. The serum when first removed is highly bacteriolytic for B. pestis, but either after heating at 56° C. for a few minutes, or after standing at room temperature for several days, the serum becomes entirely inactive. Fresh rabbit's serum, which in itself is not bacteriolytic for B. pestis, was added to the heated serum from convalescent plague

patients, and the mixture proved capable of destroying large numbers of B. pestis. The antipesteux serum of Roux was comparable to heated serum from plague convalescents, containing large amounts of immune body, but no complement. The author believing that the efficacy of the antipostcux serum was dependent upon its reactivation in the body by the complement of the individual, made experiments to determine the complement content of the blood of very ill or dying plague patients. It was found impossible to reactivate either serum from convalescent cases or the artificial immune sera by the addition of fresh serum from dying patients. Not only was this true, but the fresh serum appeared to have an inhibitory effect upon the action of fresh rabbit's serum, for when the fresh rabbit's serum and serum from dying plague cases were both added to immuue serum, the reactivating power of the fresh rabbit's serum was annulled and the mixture became incapable of destroying B. pestis. The author concludes, that in cases dying of plague, the complement is not only dccrcased, but an anticomplement is formed. These results, he believes, explain the failure of the artificially prepared antiplague sera to affect the course of plague when given late in the disease.

HYGIENE AND PUBLIC REALTH.

UNDER THE CHARGE OF

CHARLES HARRINGTON, M.D., ASSISTANT PROFESSOR OF HYGIENE, HARVARD MEDICAL SCHOOL.

Scarlet Fever, Diphtheria, and Aphthous Fever from Infected Milk .-An outbreak of undoubted scarlet fever, due to infected milk, is reported by Ekholm (Zeitschrift für klinische Medicin, xlix., Nos. 1-4). Six families supplied with milk from the same source were invaded by the disease, and investigation showed that at the farm from which the milk was derived the milking was done by a milkmaid who, shortly before, had been treated for a phlegmonous angina. Another outbreak attributed, like the celebrated "Hendon epidemic," to diseased cows, recently occurred in Lincoln, England. All of the cases, forty in number, were patrons of a dairy at which the cows were found to be afflicted with a vesicular eruption on the teats and elsewhere. The majority of the patients were seized on the same day, the symptoms being sore throat, vomiting, and sometimes diarrhea, with, in many cases, a scarlatiniform eruption on the third day, followed a week later by desquamation. In one household no less than fourteen persons were seized, but not one of them, or of the others who sickened, was seriously affected.

Five cases of diphtheria have recently been traced by Dr. A. K. Chalmers, M. O. H. for Glasgow, to milk from a farm conducted by a farmer whose throat was found to be affected with an abundance of B. diphtheriæ, but who at no time had had any definite symptoms of the disease, nor had considered

himself to be seriously ill. That the number of cases among his patrons was no larger was supposedly due to the fact that only occasionally had he personally milked the cows.

During the recent epidemic of foot-and-mouth disease in New England, Dr. E. F. Brush (Journal of the American Medical Association, June 20, 1903) found that at Concord, Massachusetts, where 327 cattle had been killed hecause of the disease, but one owner of the infected animals was a milk peddler, and his was the first herd in which the disease was discovered. Among his customers four persons were found who were ill: An old gentleman and his wife, with slight fever and nausea; their son, with mild aphthæ and herpetic eruption, and a middle-aged woman, with a very sore mouth and characteristic vesicular eruption of aphthæ. At Lawrence he found a family of five children, all of whom had aphthæ after drinking milk supplied by a dealer whose cows were shortly afterward condemned. the children had sore mouth, although not very sick, but the fifth was very ill, with vomiting, diarrhea, and fever. The tongue and lips were very much swollen and covered with hlisters. After four days of sickness, convulsions appeared, but ceased when a change was made to another dealer. the disease in a child, aged thirteen months, is reported by Josias (Gazette hebdomadaire de Médecine et de Chirurgie, June 1, 1902), who traced the trouble to a dairy where the disease existed among the cows.

Cigar Stumps and Tuberculosis.—That stumps of cigars that have been smoked by consumptives can transmit tuberculosis immediately after they have been smoked, and even two weeks afterward if they have been kept in a dry place, has been shown hy L. Peserico (Archiv für Hygiene, xliv. p. 189). If kept in a moist place they lose their infectiveness after ahout ten days, because it seems that the water dissolves something from the tobacco which destroys the virulence of the tuberculous organisms, although it does not take away their vitality. Examination of cigars as bought in the shops, with respect to the presence of the tubercle hacillus, gave no positive results. The content of germs in cigars and cigarettes shows that these are neither abundant nor very various. Moulds and potato bacilli are first in abundance, then come several species of proteus and pus cocci, the presence of which can explain several purulent affections for which smokers are sometimes inclined to blame their cigars.

Purification of Water in the Field.—The requirements of any quick chemical method of purification of water are, according to Nesfield (Public Health, July, 1903, p. 601), certainty of effect; the imparting of no taste to the water; absence of any noxious chemical substances in the water; and adaptability to foreign travel—that is, the agents employed must be easily carried and not prone to change on keeping. By experiment he demonstrated that 0.125 g. of chlorine is sufficient to sterilize, within five minutes, a litre of water infected with broth cultures of B. coli, B. typhosus, and Shiga's dysentery bacillus. After the process of sterilization is completed the free chlorine can be removed by means of commercial sodium sulphite, the resulting compounds being sodium sulphate and hydrochloric acid, the latter in turn hecoming

neutralized at once by the alkali present in the commercial sulphite. One hundred grams of chlorine will suffice to sterilize 176 gallons of water, and will require 177.46 grams of sulphite for neutralization. The gas can be stored in liquid form in lead-lined iron cylinders having a jet with a very fine capillary canal controlled by a tap. The sulphite may be made into tablets or cakes. For use in water-bottles, tablets containing 1.5 grains of bleaching-powder and 0.5 grain of sodium bicarbonate may be employed. These evolve nascent chlorine when placed in water, and will sterilize a pint of water within ten minutes. The chlorine and its resultant bad taste may be removed by a fourth of a grain of sodium sulphite, which he recommends to be used in the form of tablets coated with a film of gelatin, which will dissolve in ten minutes. The chlorinating and the sulphite tablets may be introduced together, the latter beginning to act when the former has served its purpose, and the water is thus made sterile and tasteless in fifteen minutes.

Disinfectant Properties of Corrosive Sublimate and of Alcohol. -The practical value of corrosive sublimate in solutions of 1:1000, 1:5000, and 1: 10,000 has been investigated by HARRINGTON and WALKER (Boston Medical and Surgical Journal, April 23, 1903, p. 435), who employed as test objects silk threads impregnated with bouillon cultures of B. typhosus, B. diphtheriæ, staphylococcus pyogenes aureus and albus, and B. coli communis, B. pyocyaneus, and B. anthracis. The threads were used in both the wet and dried state. Following are their conclusions: (1) Different species of pathogenic bacteria and different cultures of the same species vary very greatly in their resistance to the action of corrosive sublimate. (2) With some species resistance is diminished in a remarkable degree by a condition of dryness, so that even the 1:10,000 solution can bring about sterility in a very short time. But some species are not materially affected in this respect by dryness. (3) Corrosive sublimate in as weak solution as 1:5000 is ineffective against the common pathogenic bacteria, including the pus organisms, when they are moist, excepting after prolonged contact. Since fifteen minutes' contact is not sufficient for the destruction of B, coli communis, B. pyocyaneus, and staphylococcus pyogenes albus in the moist state, or of staphylococcus pyogenes aureus, whether moist or dry, the use of this and of weaker preparations in surgical work and for irrigation and similar purposes should be abandoned. (4) Corrosive sublimate in the 1:1000 solution is very slow in its action on some of the commonest of the skin bacteria, and, since under the most favorable conditions more than ten minutes' contact may be necessary for it to kill staphylococcus pyogenes albus, it should not be relied upon to any great extent to insure sterility of the hands or of instru-The mere dipping of the hands for a few seconds into solutions of this strength can serve no useful purpose, but, on the contrary, can lead to much harm by inducing a false sense of security. In order to produce sterility of the hands through the use of this preparation, absolute dryness of the bacteria present would be essential; but a condition of the skin which would insure such dryness would also insure the bacteria not on the very surface against contact with the poison. (5) Corrosive sublimate in any of the strengths commonly employed is a much overrated disinfectant, and under

the best of conditions is so uncertain in its action that it would be of advantage to abandon its use altogether in surgery.

The same observers (Ibid., May 21, 1903, p. 548) studied the germicidal power of alcohol in various dilutions, namely, 15, 20, 25, 30, 40, 50, 60, 70, 75, 80, 85, 90, 94, and 99 per cent. against the same organisms, and came to the following conclusions: (1) Against dry bacteria, absolute alcohol and ordinary commercial alcohol are wholly devoid of bactericidal power, even with twenty-four hours' direct contact, and other preparations of alcohol containing more than 70 per cent. by volume are weak in this regard, according to their content of alcohol-the stronger in alcohol, the weaker in action. (2) Against the commoner, non-sporing, pathogenic bacteria in a moist condition any strength of alcohol above 40 per cent. by volume is effective within five minutes and certain preparations within one minute. (3) Alcohol of less than 40 per cent. strength is too slow in action or too uncertain in results against pathogenic bacteria, whether moist or dry. (4) The most effective dilutions of alcohol against the strongly resistant (nonsporing) bacteria, such as the pus organisms in the dry state, are those containing from 60 to 70 per cent. by volume, which strengths are equally efficient against the same organisms in a moist condition. (5) Unless the bacterial envelope contains a certain amount of moisture it is impervious to strong alcohol; but dried bacteria, when brought into contact with dilute alcohol containing from 30 to 60 per cent. of water by volume, will absorb the necessary amount of water therefrom very quickly, and then the alcohol itself can reach the cell protoplasm and destroy it. (6) The stronger preparations of alcohol possess no advantage over 60 to 70 per cent. preparations, even when the bacteria are moist; therefore, and since they are inert against dry bacteria, they should not be employed at all as a means of securing an aseptic condition of the skin. (7) Provided the skin bacteria in the deeper parts can be brought into contact with disinfectants, alcohol of 60 to 70 per cent. strength may be depended upon usually, but not always, to destroy them within five minutes.

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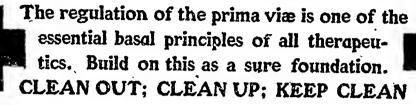
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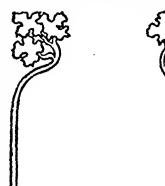
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AMERICAN JOURNAL OF THE MEDICAL SCIENCES.

DECEMBER, 1903.

THE ANATOMICAL BASIS OF THE ARGYLL-ROBERTSON PUPIL.

BY HENRY M. THOMAS, M.D., JOHNS HOPKINS UNIVERSITY, BALTIMORE.

WE are indebted to Argyll-Robertson, the noted ophthalmological surgeon of Edinburgh, for first drawing accurate attention to the condition of the pupils in diseases of the spinal cord, especially in tabes. He was not the first, however, to notice abnormalities of the pupil in this disease.

Romberg¹ (1851), in his classical description of tabes, after referring to the occurrence of blindness, says: "Even when the optic nerve was not implicated I have repeatedly found a change in the pupil of one or both eyes, consisting of a contraction with loss of motion, which in one case—that of a man, aged forty-five years—attained to such a height that the pupils were reduced to the size of pin-heads." Duchenne, in the 1872 edition of his work (first edition in 1858-59), refers to symptoms that he had long noticed in cases of progressive locomotor ataxia, but to which he had not called sufficient attention, i. e., "the contraction of the pupil, which in these cases is significant, as I have shown, of paralysis of the sympathetic one side, but at times on both; it often exists from the onset." refers to a case in which dilatation of a small pupil occurred during the lightning pains. Nothing was said as to the reflex. This was written after Argyll-Robertson's papers had been published, but, as is well known, the great French describer of new diseases cared but little for the work of other observers, and only read the literature after he had

¹ The Sydenham Society Translations, 1853, vol. ii. p. 397. vol. 126, No. 6.—DECEMBER, 1903.

written his own description, and even then he seemed to regard it as a rather useless occupation.

Argyll-Robertson's papers were published in 1869, in the February and December numbers of the Edinburgh Medical Journal. It is interesting to note that he did not advance the symptom that is so generally called by his name as a sign of locomotor ataxia, but simply as an interesting coudition associated with disease of the spinal cord. The first paper is entitled "On an Interesting Series of Eye Symptoms in a Case of Spinal Disease, with Remarks on the Action of Belladonna on the Iris," etc. This was a case of tabes in which there was optic atrophy of the right eye. Both pupils were contracted to a little more than pinpoints—the right eye the smaller of the two. He says: "I could not observe any contraction of either pupil under the influence of light, but on accommodating the eve for a near object both pupils contracted." There was color-blindness of the right eye. Atropine dilated the pupils, and Calabar bean contracted them. The myosis he discusses at some length and explains it by a paralysis of the sympathetic action. He refers to a number of authors who have noted contraction of the pupils in connection with spinal disease. In this paper he does not go into the question of the light reflex, but occupies the rest of the article in discussing the action of atropine and Calabar bean on the iris.

The title of the second article is "Four Cases of Spinal Myosis, with Remarks on the Action of Light on the Pupil." After giving the history of the four cases he says: "In one case the characteristics of locomotor ataxia were well marked; in the other two the form of spinal affection is doubtful; while in the fourth patient, as I have already mentioned, the symptoms of spinal disease are by no means well marked." I think, however, there can be little doubt that they were all cases of tabes, with the possible exception of the fourth. After referring to the first paper he says: "But I now desire to direct special attention to a very remarkable circumstance which I noticed in the case which formed the subject of my previous paper, and which I again observed in all the above cases, viz., that, although the retina is quite sensitive and the pupils contract during the act of accommodation for near objects, yet an alteration in the amount of light admitted to the eve does not influence the size of the pupil." Although in this sentence Argyll-Robertson says nothing about the contracted pupil as being characteristic of the condition he was describing, he did, however, consider it so. It was present in all of his cases, and it was, as we shall see, an important factor in the theory which he advanced as explaining the condition. Since then, however, it has been shown that this peculiar pupillary action, although often, is not always associated with spinal myosis.

Contracted pupils in association with tabes had been pointed out long before Argyll-Robertson's papers, and the new condition that he called attention to is that which he described in the sentence I have quoted above, and it defined accurately what at present is understood as the Argyll-Robertson pupil. This pupillary condition, which Argyll-Robertson advanced simply as a symptom of spinal disease, has become to be regarded as almost pathognomonic of tabes and its allied disease, general paresis, and is universally called by his name. The modern view is well put in the excellent article by Moebius on "Tabes Dorsalis," in the Twentieth Century Practice of Medicine, 1897, vol. xi. p. 822. Under the heading "Reflex Iridoplegia," he points out the great importance of the symptom. He considers it the most important symptom of tabes, occurring early and found in about three-fourths of the cases. He states that it is only present in tabes and general paresis, with the exception of extremely rare focal lesions in the region of the corpora quadrigemina.

It would be extremely interesting to follow the fortunes of this symptom from the time Argyll-Robertson was delivered of it to its present assured position in the tabetic hierarchy, in the company of Romberg's symptom, Westphal phenomenon, and Charcot joints. That, however, is impossible at this time, but I should like to mention one or two facts in this connection.

Leyden, in his Klinik der Ruckenmarks Krankheiten, 1875, does not refer to it in connection with tabes, but he makes a curious reference in a footnote (vol. ii. p. 176) when writing of acute myelitis. It is as follows: "Argyll-Robertson' described another, until then unknown, ocular phenomenon as a result of disease of the spinal cord, to wit, loss of color sense." This would seem to show that he had not looked up the original reference.

As far as I have seen, the symptom was first called after its describer by Dr. T. Granger Stewart, his colleague at Edinburgh. In an excellent article in *Brain* (1879–80, vol. ii. p. 181), concerning "The Eye Symptoms of Locomotor Ataxia," he says (p. 185): "Associated with the myosis, but sometimes occurring independently of it, is another curious feature which was first described in 1869 by Dr. Argyll-Robertson, and which for convenience we are accustomed at the bedside to call the Argyll-Robertson symptom."

That this symptom is an important sign of tabes is so well recognized by all physicians who are interested in the subject that this aspect need not detain us; but as soon as we leave the facts of its occurrence and its importance as a diagnostic sign and try to explain the process which causes it we find ourselves in a maze of conflicting opinions. ArgyllRobertson's explanation is most interesting, and shows clearly the extent of physiological knowledge at that time: "The only possible solution of the difficulty is to be found in the theory that for the contraction of the pupil under light it is necessary that the ciliospinal nerves remain intact, and as in these cases of myosis the ciliospinal nerves are paralyzed, light does not influence the pupil. But hitherto this contraction of the pupil under light has been invariably referred to reflex stimulation of the ciliary branches of the third pair, which supply the circular fibres of the iris. If this latter view were correct I see no reason why in these cases light did not influence the pupils. In all of them the retina was thoroughly sensitive to light, and in all of them the ciliary branches of the third pair were healthy and active (as was shown by the further contraction of the pupil during the act of accommodation, which can only be referred to these nerves): but in all these were symptoms of spinal disease, and in all myosis due to paralysis of the ciliospinal nerves. I am therefore inclined to the former view, in which case it is necessary to assume that the contraction of the pupil, which normally occurs when light is admitted to the eye, is not, as has been hitherto supposed, an excellent example of reflex action, but an isolated example of normal temporary reflex paralysis." Argyll-Robertson was fully aware that the symptoms said to be due to injury of the third nerve (a dilated pupil which was inactive to light) spoke against his theory, but he thought that the cases when reported were not conclusive, and that "for a thorough solution of this question experimental and clinical observations are necessary."

Since that sentence was written numberless clinical observations and many experiments have been made, but the solution of the question is still to be found. The description which Argyll-Robertson gave of the condition has only been changed in that it has been shown that myosis, although a common is not a constant feature, and that the condition is almost exclusively a symptom of tabes dorsalis and dementia paralytica, and not of diseases of the spinal cord in general. Both of these facts must have soon attracted the attention of the distinguished Edinburgh observer, but as far as I have been able to discover he has never published anything else on the subject.

For a thorough solution of the question we must have a complete knowledge of the anatomical and physiological relations which underlie the normal activities of the pupil. Unfortunately, however, our knowledge in these directions is far from complete, as, indeed, in what direction is it not? And in discussing the problem one must often speak with hesitation. However, I shall try to state, as briefly as possible, that which is generally accepted as being true.

First, in regard to the anatomy: The movements of the pupil depend in the end upon the action of the muscles of the iris. The iris has two muscles, a circular or sphincter muscle, and a radial or dilator muscle. The presence of a sphincter muscle has been unquestioned for a long time, but there has been much dispute regarding the dilator muscle, and it is only very recently that what seems to be definite proof of its existence has been brought. This proof was at first physiological by Langley and Anderson, but later Grunert, after using special methods of bleaching and staining, demonstrated in the human iris a layer of small muscle fibres lying between the stroma and the posterior epithelium. De Vries has studied the embryological development of these fibres, and believes that they are derived from one of the layers of epithelium which cover the ciliary body. Szili has made a simi ar investigation.

The muscles of the iris are supplied by nerve fibres which enter the posterior aspect of the eyeball through the numerous branches of the ciliary nerve. These branches are derived from two distinct stems. The shorter and more numerous branches come from the ciliary ganglion, which is in close connection with the third nerve, and make up the short ciliary nerves. The other branches are divisions of the long ciliary nerve, which is given off from the nasal branch of the first division of the fifth cerebral nerve. The branches of the long ciliary nerve join with some of those of the short ciliary nerves and enter the eyeball together, and seem to have a similar distribution. It has, however, been shown by physiological experiments that the long ciliary nerve contains the fibres which supply the dilator muscle of the iris, and that the short ciliary nerves are distributed to the sphincter and the ciliary muscles. The long ciliary nerves are made up of neurons which have their cell bodies in the superior cervical sympathetic ganglion. It has been known for a long time that the cervical sympathetic contains fibres which caused dilatation of the pupils; thus as far back as 1727 Petit noted that when the sympathetic was cut the pupil on that side became smaller, and about the middle of the last century a number of experimenters showed that stimulating the cervical sympathetic caused dilatation of the pupil.

Budge and Waller, in papers published in 1851 and later, recorded that if the sympathetic be cut below the superior cervical ganglion the part between the cut and the ganglion degenerated, and that stimulation of it no longer caused dilatation of the pupil; whereas, there were many undegenerated fibres beyond the ganglion, and that stimulation of the ganglion or the nerve beyond caused prompt dilatation. If,

¹ Journal of Physiology, 1892, vol. xiii. p. 554.

² Arch. f. Augenheilkunde, 1898; translated in Archives of Ophthalmology, July, 1901, Bd.

³ Nederlandsche Tijdschr. v. Geneesk., 1901, i. p. 194, cited from abstract in Archives d'Ophthalmologie, 1901, Bd. xxi. p. 484.

⁴ V. Graefe's Arch. f. Ophthal., 1902, Bd. liii. p. 459.

however, they cut out the ganglion they were unable after a few days to get any dilatation of the pupil by stimulation of the nerve above or of the carotid plexus or of the eyeball itself.\(^1\) Langley, working with colleagues and alone, has, in the course of his illuminating investigations of the sympathetic nervous system, shown that the pupillary dilator fibres run an uninterrupted course from the superior cervical ganglion to the iris. The proof depends largely upon the action of nicotine, for when this drug, in solutions of from 0.5 per cent. to 1 per cent., is applied to a sympathetic ganglion it blocks the transmission of impressions through it, although it does not affect to any extent the conductivity of the nerve fibre. Langley believes this to be due to paralysis of the nerve endings around the cells of the ganglion; that is, a break at the point of contact between the pre-ganglion and postganglion fibres.

Now, if the superior cervical ganglion be thus treated with nicotine it is found that stimulation of the cervical sympathetic causes no action; whereas, if the several branches which leave the ganglion above be stimulated, their special functions follow; among these is wide dilatation of the pupil. This is taken to mean that the superior cervical ganglion is a relay station, and gives origin to all the fibres by which sympathetic effects are produced in the head. That these post-ganglionic fibres run without interruption to the peripheral structures, in our case the iris. Langley thinks is indicated by the fact that when nicotine is injected into the general circulation, so paralyzing all the sympathetic ganglia, the effect, in so far as the cervical sympathetic is concerned, is just the same as if nicotine had been applied locally to the superior ganglion—i. e., stimulation below the ganglion produces no effect, while above the fibres are as excitable as ever. The force of this argument depends upon the belief that if these fibres made connection in any other sympathetic ganglion, nicotine would paralyze them at that point and block stimuli applied centrally, although it does not paralyze their endings in the peripheral structures. There are experiments which seem to substantiate this view, and, indeed, to indicate that there are no commissural fibres between sympathetic ganglia.

However this may prove to be, there are other facts which go to prove that there are no ganglion cells interposed in the course of the fibres between the superior cervical ganglion and the dilator muscle of the iris. Schultz has shown that after this ganglion has been cut out and time allowed (eight days) for degeneration of the post-ganglion fibres, cocaine, which in normal eyes and directly after the operation causes dilatation of the pupil, no longer has any effect, which indicates

² Archiv f. Anat. u. Physiol. (Physiol. Abthell), 1898, p. 47.

¹ Budge. Lehrhuch der speciellen Physiol, der Menschen, 1862, Bd. viii, p. 769.

that the degeneration has reached the peripheral endings in the dilator muscle, which would not be the case were another ganglion cell interposed.

Cutting the ciliary nerve back of the eyeball and operations on the eyeball itself have been followed by Nissl changes in some cells in the superior cervical ganglion, which fact speaks for a direct passage of fibres between the structures. The exact course of the fibres from the ganglion to the iris has not been absolutely determined, but is believed to be by the carotid plexus to the Gasserian ganglion and the first division of the fifth nerve, then by its nasal branch to the long ciliary nerve, and so to the iris.

I have stated above that the short ciliary nerves arise from cells in the ciliary ganglion, and are distributed to the sphincter of the iris and the ciliary muscles. This is the commonly accepted view, but it is by no means universally admitted. There has been much dispute over the nature of the ciliary ganglion; that is, whether it is a spinal ganglion and conducts sensory stimuli, as was thought by His, Remak, Van Gehuchten, and others; or whether it is a sympathetic ganglion and conducts motor impulses, as Retzius, v. Michel, v. Koelliker, among others, have held. Bach² and Marina³ have given good reviews of the subject, where references to the literature can be found, as well as a description of their own experiments. The difference of opinion has been due to the variety of methods used in attacking the problem and the fact that animals of different species were employed by the different observers. Langley and Anderson, experimenting with nicotine, found that this ganglion stood in the same relation to the pupillary fibres running in the third nerve that the superior cervical ganglion bore to the analogous fibres of the cervical sympathetic; for if nicotine be applied to the ciliary ganglion, stimulation of the third nerve no longer causes contraction of the pupil, although stimulation of the ciliary nerve does. Marina got similar results by injecting nicotine into the orbit. If the third nerve be cut degeneration can be traced up to but not beyond the ganglion. Injury to the iris or cutting of the ciliary nerve is followed by Nissl changes in the cells of the ganglion (Bach, Marina, Bumm⁶). These facts can only be interpreted by the belief that the ciliary ganglion is, at least in part, a sympathetic ganglion, and gives origin to the fibres which supply the sphincter muscle of the iris and the ciliary muscles. These fibres are sympathetic, postganglionic fibres, and are for the most part non-medullated. When

¹ Marina. Deutsche Zeitschrift f. Nervenheilkunde, 1899, Bd. xiv. p. 357.

² Vou Graefe's Arch. f. Ophthal., 1899, Bd. xlvii. pp. 339-551.

³ Deutsche Zeitschrift f. Nervenheilk., 1899, Bd. xiv. p. 357; 1901, Bd. xx. p. 369.

⁴ Journal of Physiology, 1892, vol. xiii. p. 460.

⁵ Apolant. Arch. f. mikrosk. Anat., 1896, Bd. xlvii. p. 655.

⁶ Neurol. Centr., 1902, Bd. xxi. p. 423.

we remember that these muscles are composed of smooth muscle fibres, which have developed from epithelium, we are not surprised at this arrangement, for it would be a unique occurrence should such muscles be supplied directly by a cerebrospinal nerve.

The ciliary ganglion seems to be a more complicated structure and to be connected with other nerves besides the third. Dissection shows that it is connected by a filament with the ophthalmic branch of the fifth, and that it also receives a root from the sympathetic by the cavernous plexus. Histological examination shows that the ganglion contains cells of various character, and that there is quite a variation in this regard between animals of different species. Marina found that by destroying the cornea and so injuring the endings of the fifth nerve, a subsequent examination of the ciliary ganglion by Nissl's method showed that certain of its cells had undergone degenerative changes. After iridectomy there were a greater number of degenerated cells. This degeneration was still greater if the eveballs were eviscerated, and greatest of all when the ciliary nerves were cut. He found in monkeys, together with the degeneration in the ciliary ganglion, degenerated cells in the Gasserian ganglion and less evidently in the superior cervical sympathetic ganglion. slightly different results, as he was unable to find any degenerated cells when the cornea was alone injured, whereas if he removed the iris and ciliary bodies he got degeneration in practically all of the cells. these writers appear to consider the ciliary ganglion as a mixed ganglion, containing both sympathetic and spinal cells. Bernheimer, experimenting in the same manner, thought that he got evidence that the ganglion was almost entirely spinal. Marina states that in monkeys the proportion is seven-eighths sympathetic and one-eighth spinal. The latest investigation of this subject is one by Bumm, but as yet I have only seen an abstract of the paper which he read before a society of alienists in April of last year. His investigation was particularly to find out the character of the cells which did not degenerate after the cutting of the ciliary nerve. He counted the number of ganglion cells which were normally present in a ciliary ganglion, and found the average to be 6432. After cutting the ciliary nerves there were left 3845 unaf-He also cut out the superior cervical sympathetic ganglion and found that the cells were then reduced to 2587. The nature of these remaining cells is undetermined; they are too numerous to be simply connecting cells (Schaltzellen). There are some T-shaped cells which he thinks belong to the fifth nerve, and he says that perhaps the others are to be brought into connection with the intraorbital ganglion, which has been lately described.

¹ Marina. Deut. Zeltsch. f. Nervenhk., 1899, Bd. xiv. p. 357.

Von Graefe's Arch. f. Ophthal., 1899, Bd. xivil.
Neurol. Contr., 1902, Bd. xxi. p. 423.

The pre-ganglionic fibres which carry impulses to the pupillary fibres from these two ganglia—the superior cervical sympathetic and the ciliary—have also given rise to a good deal of controversy. Those which run to the superior cervical ganglion are, perhaps, better known.

Budge, in the middle of the last century, showed that they left the central nervous system from the lower part of the cervical and upper part of the thoracic cord. He determined this by direct stimulation of the cord itself, and stimulation of the roots as they left the intervertebral ganglia. It was in this region of the cord that Budge placed his "inferior ciliospinal centre." He also assumed a higher centre which he placed near the hypoglossal nerve, but he seems to have based his belief in this on anatomical rather than experimental grounds. This question has been studied by a number of investigators. Among the later ones I may mention Madame Dejerine, Langley, and his associates. Langley believes that the pupillary fibres leave the cord by the first, second, and to some extent the third thoracic roots. His experiments with nicotine show that the fibres run through the lower cervical ganglia, to end about the cells in the superior cervical ganglion. These pre-ganglionic fibres are fine, medullated fibres, and arise from cells somewhere within the central nervous system. It is believed that the cells of origin of fibres running to the sympathetic system in general lie in or near the segment from which the fibres leave the cord, and Gaskell thinks that they are to be found in the lateral column of the cord. There is, however, no very conclusive proof of this.

It was about the middle of the last century that physiologists showed that the third cerebral nerve contained pupillary constrictor fibres. I do not know who first made this observation, but Romberg, in his text-book on Nervous Diseases, refers to dilatation of the pupil as a symptom of paralysis of the third nerve, and Budge, in his Physiology, speaks of contraction of the pupil which followed stimulation of the third, in recently killed animals and man. Argyll-Robertson, in 1869, did not feel that this point was definitely proved, and explained the contraction of the pupil to light by inhibition of the ciliospinal (dilator centre); and very lately Marina, from a study of the cases of ophthalmoplegia, believes that he has found evidence that the third nerve may be severely injured without causing paralysis of the sphincter of the iris. He explains this not by denying that the third nerve contains pupillary fibres, but by the assumption that the ciliary ganglion is the chief reflex centre for the iris. However, there can be little doubt that the third nerve does contain these fibres, and that they represent the pre-ganglionic fibres of the ciliary ganglion. The principal question in dispute is as to the position of the cell bodies from which they arise.

One would naturally look for them in or near the nucleus of the third nerve, and Bernheimer seems to have determined in just which group of the cells of the nucleus they are to be found.

The third nucleus is a complicated collection of nerve cells lying ventrally to the aqueduct of Sylvius, at the level of the corpora quadrigemina, and has been more or less accurately divided into smaller groups of cells which are believed to bear definite relations to the several muscles supplied by the third nerve. Bernheimer's work has been particularly valuable in this connection. He, as well as other investigators, has shown by the use of the Nissl method that there are two collections of cells within the third nucleus which do not seem to bear any relation to the external muscles of the eye. These are in the anterior part of the nucleus, and occupy a medial position; and he designates them as the large-celled, unpaired, median nucleus; and the small-celled, paired, median nucleus. This nucleus is practically the same group of cells which we have been accustomed to call "the nucleus of Edinger-Westphal."

In a brilliant experimental work Bernheimer¹ has proved that if this small-celled, paired median nucleus be injured the sphincter of the iris is paralyzed. He operated on six monkeys, but was successful in destroying this group of cells in only one case. In this animal the pupil was dilated and did not react to light. The brain of this, as well as that of the other animals, was most carefully examined, and serial sections made, and it was shown that it was in fact this special nucleus that was injured in the one animal; while in the other five, in whom the pupils were perfectly normal, it had not been touched. Whether or not the pupil was also paralyzed during accommodation seems not to have been determined, but it is probable that this movement is represented in close connection with the reflex movement of the iris, possibly in the large-celled, unpaired, median nucleus.

In this very brief review I have endeavored to trace what is known of the path by which the motor influences governing the iris leave the central nervous system and reach the eye; and I believe that we may state as the best substantiated view the following conclusions: The sphincter and dilator muscles of the iris are composed of smooth muscle fibres, and are each controlled by sympathetic nerve fibres. As is true of the sympathetic nervous system in general, the path from the central nervous system to the periphery is made up of two sets of nerve fibres—the so-called pre-ganglionic and the post-ganglionic fibres. The pre-ganglionic fibres, which control the sphincter muscle of the iris, arise from a definite group of cells in the anterior part of the nucleus of the third nerve, and run to the ciliary ganglion. From this ganglion the

¹ Von Graefe's Arch. f. Ophthalmologie, 1901, Bd. lii., Heft ii. p. 302.

post-ganglionic fibres arise and are distributed through the short ciliary nerve to the sphincter muscle. The path controlling the dilator muscle is a longer and more complex one. Its pre-ganglionic fibres arise from cells in the spinal cord, which are probably situated in the lateral horns, about the level of the junction of its thoracic and cervical portion. The fibres leave the cord mostly by the first thoracic nerve and run in the cervical sympathetic to the superior cervical ganglion. From this structure post-ganglionic fibres arise, which, after a somewhat circuitous route, reach the eye and the dilator muscle of the iris through the long ciliary nerves.

The afferent path of the reflex arc, which governs the action of the pupil to light, is also not absolutely determined. The impulses start in the retina, and in general are provoked by the same sort of stimuli that give rise to visual impressions. It was at first assumed that the visual and reflex fibres were the same, and that the paths only separated beyond the primary optical centres, but later observations seem to indicate that the reflex fibres and the visual fibres are not identical. As is known, the fibres of the optic tract run to three nuclei and are believed to end there, about the cells which are contained in them. These nuclei, which are the so-called primary optical centres, are the lateral geniculate body, the anterior corpora quadrigemina, and the pulvinar of the optic thalamus. There is considerable variation in animals of different species as to the relative number of fibres which run to each of these nuclei. In man, Bach' states, most of the fibres end in the geniculate body, and the smaller number run to the two other structures. The anatomical relation of the anterior pair of the corpora quadrigemina to the nucleus of the third nerve has led most observers to assume that it was in this structure that the afferent limb of the pupillary reflex arc ended, and that its gray matter was connected by comparatively short fibres with the nucleus of the third nerve. Von Bechterew and others, experimenting on the corpora quadrigemina, found that in certain animals injury to this structure did not cause disturbance of the light reflex, and it was these experiments that first led to the supposition that the reflex fibres in the optic tract were distinct from the visual fibres.2 The endeavor to determine the course of these reflex fibres has given rise to a great deal of interesting experimentation, but it must be acknowledged that there is no definite proof in regard to their existence. We do not know from what special cells in the retina they arise. But we do know that the reflex path runs in the optic nerve to the chiasm, where there is a partial decussation, and it seems fairly certain that those fibres which arise from the temporal half of the retina do not, for the most part, decussate, but continue in the optic

¹ Bach. Deut. Zeitschr. f. Nervenhk., Bd. xvii. p. 428.

² Von Bechterew. Ibid., 1900, Bd. xvi. p. 194. 1

tract of the same side. During their course in the tract the direct and crossed fibres seem to be pretty well intermingled. There is much discussion as to just the point at which the pupillary fibres leave the optic tract. Von Bechterew' states as his present view that they leave the tract at the level between the corpus cinereum and the root fibres of the third nerve—i. e., near the place where the optic tract enters the geniculate body—and run to the posterior part of the third ventricle, where they apparently make new connections before they run to the nucleus of the third nerve

Bernheimer² concludes from his embryological examination and from the experiments which he made on monkeys that the pupillary fibres leave the optic tract just before they reach the external geniculate body, and run toward the middle line within the white matter of the corpora quadrigemina, where they turn, some going to the gray matter of this structure and others directly to the region of the sphincter centres in the third nucleus.

Bach, working in the laboratory of Prof. v. Michel, was unable to confirm Bernheimer's results. He experimented on pigeons, rabbits, cats, and monkeys, and could find no evidence, either from his own work or from a review of the literature, for the occurrence of a direct passage of fibres from the optic tract to the nucleus of the third nerve. He believes that Bernheimer's statements are due to a misinterpretation of his findings. Bach's results are practically in accord with those of most other investigators who have worked on this point, and he points out that it would be a unique circumstance to find afferent fibres ending directly about motor cells without the intervention of connecting cells. In this he does not take into account the complicated structure of the retina. The disagreement seems largely to be due to the different interpretations which the several observers have given to the picture obtained by the more delicate histological methods, particularly those of Marchi and Nissl.

Bernheimer's view is so simple and direct, and, backed as it is by such an authority, that one is naturally very much attracted to it. It assumes that the reflex arc, upon which the contraction of the pupil to light depends, is of the simplest nature. The afferent limb is made up of the pupillary reflex fibres, which arise in the retina, partially decussate in the chiasm, and run directly to the sphincter centre of the third nucleus, the centre on each side receiving fibres from both optic tracts, and being mutually connected with each other. The efferent limb is composed of fibres which arise in the sphincter centre and run directly to the sphincter muscle of the iris without making connection

Deut. Zeitschrift f. Nervenhk., 1900, Bd. xvil. p. 428.

Loc. cit. 2 Von Graefe's Arch. f. Ophthalmologie, 1899, Bd. xlvii. p. 1.

with the ciliary ganglion or elsewhere. Other authors, however, have brought forward what they believe to be evidence that the pupillary reflex fibres end in a number of different structures, among which may be mentioned the anterior pair of the corpora quadrigemina, the pulvinar, the corpus Luys, the ganglion habenula, and the gray matter about the third ventricle. Whatever the ultimate solution of the question may be, the data which we have at present is too incomplete and conflicting to allow us to accept any of the present views as final. All that one can now say is that if these fibres do not end as Bernheimer believes we do not know how they end.

Pathological examinations and direct experiments have been used to throw light on the position of this reflex arc, and I have already referred to the experiments of v. Bechterew and others, which seem to indicate that the corpora quadrigemina has little, if anything, to do with the light reflex, and those of Bernheimer, which he takes as establishing the position of the pupillary centre in the third nucleus, and I shall refer below to some very recent experiments bearing on the question; but first there are some interesting pathological observations that must be considered.

Argyll-Robertson described the pupillary condition which bears his name as a symptom of a disease of the spinal cord, and the explanation which he gave depends upon the assumption of a lesion in the ciliospinal centre of Budge. But soon afterward attention was directed to the third nucleus and the region near it, and it is about this area that the discussion was waged. Certain investigators, however, kept their attention fixed on the spinal cord; and Rieger and v. Forster, in 1881, tried to show that the ocular symptoms of tabes and general paresis were due to lesions of this structure. Their articles attracted very little attention at the time of its publication, and it was not until very lately that the work of Wolff and Bach aroused new interest in this phase of the subject. Wolff¹ gives an analysis of the cases which Prof. Rieger had collected up to that time. These are cases of general paresis and tabes which had come to autopsy. He concluded from them that whenever there is a loss of the light reflex there is also a lesion in the upper part of the cervical cord. He gives no theory as to just where the centre is, nor as to its connections. In a second article Wolff² reports an interesting case in which the Argyll-Robertson pupil occurred, and in which, among other things, a gumma was found in the posterior columns of the spinal cord at the level of the second and third cervical roots. The region of the third nucleus was apparently free. This case Wolff justly thinks is, to say the least, suggestive.

¹ Arch. f. Psych., 1899, Bd. xxxii. p. 57.

² Deut. Zeitschr. f. Nervenhk., 1902, Bd. xxi. p. 247.

A recent case reported from Rieger's clinic by Reichardt¹ is of interest in this connection as it is somewhat contradictory. He examined the central nervous system of a man, aged twenty-one years, who had had congenital immobility to light of his pupils. Whether the pupils had also been immobile during accommodation had not been determined, on account of the patient's mental condition. There was no lesion that could be demonstrated in the cervical cord, where Wolff, who had also seen the case, expected to find one; nor was there a lesion found anywhere else that might explain the condition, but, unfortunately, the region of the third nucleus was spoiled in preparation and could not be examined.

Bach² also, under the inspiration of Prof. Rieger, undertook some experiments to determine this point. He cut off the heads of cats, albino rabbits, and monkeys, making the knife pass as near the skull as possible, and at once tested the pupillary light reflex. He found that the reflex was present and remained so at times for two months. There was, however, two or three centimetres of the spinal cord left; so he altered his experiments so that he destroyed this remaining part of the cord immediately after the decapitation. After this procedure the reflex was abolished at once. From these experiments he concluded that the centre for the light reflex was to be looked for in the cervical cord, just below the medulla. His extensive anatomical investigations gave him no definite clew as to the connections of this centre, but in his next paper² he gives his reasons for thinking that it may be connected with the primary optical centres by the lemniscus and with the nucleus of the third nerve by the posterior longitudinal bundle.

In some of the later works on diseases of the nervous system the view that the centre for the light reflex is to be found in the cervical cord has been accepted, and notably by Sacki and Schmaus,⁴ and Schaffer.⁵ Ruge⁶ repeated Bach's experiments, and confirmed the result that after decapitation and removal of the remaining spinal cord the reflex was at once abolished. He noticed, however, that the size of the pupil varied greatly in the different animals experimented upon. In one they might be contracted and in another dilated, and in the mid-position in a third. From this he concluded that there must be some secondary action taking place to which the loss of the light reflex might be due. He then succeeded in cutting at the level of the calamus scriptorius and as high as the middle of the fourth ventricle, and he always found the light reflex to be present after these

¹ Neurologische Centralhlatt, 1903, Bd. xxii. p. 521.

² Von Graefe's Arch. f. Ophthal., 1899, Bd. xlvil. pp. 339 and 551.

Deut. Zeitschr. f. Nervenlik., 1900, Bd. xvii. p. 428.

Vorhsungen u. d. path. Anat. der Rucherenecke, 1901.

Anatom. klin. Vorträge an dem Geberte d. Neuropathol., 1901.

⁶ Von Graefe's Arch. f. Ophthal., 1992, Bd. liv. p. 483.

procedures, just as it had been when the cut was made in the spinal cord, and this he takes as proving that the centre is in the brain. In spite of this he thinks that the Argyll-Robertson pupil may be accounted for by a lesion in the cervical cord, and his hypothesis suggests so strongly the explanation which Argyll-Robertson originally gave that it is of special interest in this connection. He refers to the fact that the pupillary fibres of the third nerve end about cells in the ciliary ganglion and reach the iris through sympathetic fibres. He believes that it is not unreasonable to think that a lesion in the spinal cord at the level of the exit of the fibres going to the cervical sympathetic would produce such an effect on the sympathetic cells of the ciliary ganglion that they could no longer transmit the impulses received through the third nerve and so interrupt the reflex arc. Ruge gives no explanation of how such an effect could occur, nor does he seem to have taken into consideration the many experiments which have been done on the sympathetic nervous system.

Bach, together with Meyer, has reported some additional experiments, the results of which have led him to modify his former view. These authors did not know of Ruge's work until their own experiments had been finished. They used the apparatus which Meyer had devised for maintaining artificial respiration, and were thus able to observe the animals for a considerable time. They used full-grown cats, and found that section of the cervical cord 1 mm. or 2 mm, below the medulla caused no loss of the pupillary reflex, but that if the cut passed just at the spinal end of the fourth ventricle the reflex was abolished. If the section were unilateral it was the reflex of the opposite eye which was lost. Bach and Meyer suppose that in this region there is a centre of great importance for the pupillary light reflex. They consider that it is an inhibitory centre, for when the medulla and fourth ventricle are simply exposed the pupils become contracted and react very little, if at all, to light, presumably from irritation of this centre, and if then a cut be made in the middle of the fourth ventricle, or even above, the pupils again become about the normal size and react actively to This is equally so in both eyes, even when the cut is unilateral. They believe that there must be another centre for the light reflex—a subordinate centre which is situated not below the posterior corpora quadrigemina. They give an elaborate diagram, which is a modification of the one which Bach had already given. In this they leave it an open question whether the third nucleus plays any part in the reflex act or whether the efferent path is not composed of fibres which run directly from the two centres to the ciliary ganglia. They believe that the efferent path decussates, at least for the most part, and passes

¹ Von Graefe's Arch. f. Ophthal., 1903, Bd. lv. p. 414.

to the eye of the opposite side, and that there is no connection between the reflex centres of the two sides. The afferent path, after having decussated in the chiasm, passes, they believe, only to the upper reflex centre of the same side, and that the path from there to the inhibitory centre is also direct. In their account of symptoms which follow lesions in the various parts of this complicated reflex mechanism they do not indicate where we are to look for the lesions which underlie the Argyll-Robertson pupil. Bach and Meyer have added the report of some more elaborate experiments along this same line. They exposed the medulla and stimulated mechanically the floor of the fourth ventricle, and were able to produce changes in the size and action of the pupils which spoke for the presence of their inhibitory centre and also for the presence of the centre which has to do with the dilatation of the pupil, probably also inhibitory. They cut out the medulla and allowed the animals to become asphyxiated, when the pupils dilated ad maximum, to again contract when artificial respiration was recom-Electrical stimulation of cerebral cut surfaces caused dilatation. From this they conclude that there are other parts of the central nervous system which are important for pupillary dilatation. experiments, as well as those of Rieger, show that a lesion of the upper part of the cervical cord can hardly be held accountable for the symptoms unless it does so through the agency of the ciliospinal nerve. This is Rieger's supposition, and what Argvll-Robertson believed.

While practically all observers have assumed that the lesion underlying the Argyll-Robertson pupils was to be looked for in the central nervous system, Marina² has called particular attention to the importance of the ciliary gauglion as a centre for the pupillary light reflex. I have already referred to his careful anatomical and experimental studies, which have done much to make our knowledge of this ganglion more accurate. He has also examined the ciliary ganglion in various pathological conditions, and he gives the results of his findings in seventy cases. Among these were thirty-six cases of dementia paralytica, five of tabes, and twenty-nine of other diseases. He seems to have fully recognized the difficulty in the interpretation of Nissl changes, and to have endeavored to control his findings. His conclusions are that in dementia paralytica and in tabes, when the pupils have reacted normally during life, no changes are to be found in the ciliary ganglion after death; but that when there has been an abnormal pupillary reaction there will be found more or less evident changes in the cells of this ganglion. The changes indicate, he thinks, a slowly progressing degeneration of the cells. He also finds degeneration of the

¹ Von Graefe's Arch. f. Ophth., 1903, Bd. 1vi. p. 297.

² Deut, Zeitschr. f. Nervenhk., 1901, Bd. xx. p. 369.

ciliary nerve particularly well marked in the cases of tabes. No change in the third nerve or its nucleus was found.

In a number of cases Marina examined the superior cervical sympathetic ganglion, and although his results were not so definite as in the case of the ciliary ganglion, it did seem to him that when the pupils were normal and no changes were found in the ciliary ganglion there were little or no changes in the superior cervical ganglion. He, however, does not mean to draw a parallel between these two organs.

Marina was unable to determine a constant microscopic difference in the ciliary ganglion between the cases with Argyll-Robertson pupils and those in which the pupils were completely immobile, but he calls attention to the fact that in the great majority of cases there were some normal cells remaining. He speaks of the complexity of the problem and of the many undetermined factors in regard to the action of the pupil during convergence and accommodation. In a very recent paper1 he has studied experimentally the contraction of the pupil during convergence, and he believes he has proved that the action is entirely independent of the third nucleus. He transplanted the rectus internus into the insertion of the superior oblique and into that of the rectus externus, in several monkeys, and found that wherever the eyes were converged without relation to the muscle which brought about the position the pupil contracted. He suggests as a possible hypothesis that the contraction may be caused by stretching of the short ciliary nerves, and so stimulating the ciliary ganglion and causing a contraction of the pupil this way.

Although he admits the presence of other reflex centres for light, Marina insists upon the importance of the ciliary ganglion, and he predicts that the oftener it is examined and the more it is studied in his relation the greater this importance will become. This work is very interesting just now, when more attention is being paid to the sympathetic ganglia as possible reflex centres, and one is reminded of the work of Müller² and others, which seems to show that the reflex activities of the bladder are largely under the control of the sympathetic ganglia in its neighborhood. The mechanism which controls the bladder and that which controls the iris have many points of analogy, and it is interesting to remember how often they are both disturbed in the early stages of tabes.

Suggestive as all this undoubtedly is, it cannot be said to be anything more, for our knowledge of the sympathetic nervous system is far too incomplete and inexact to allow us to formulate any clear idea of how the ciliary ganglion could act as a reflex light centre. Marina

¹ Deutsche Zeitschrift für Nervenheilkunde, 1903, vol. xxiv. p. 274.

² Ibid., 1901, Bd. xxi. p. 86.]

advances no theory. If I have understood Langley, who appears to have the clearest conception of the sympathetic, or, to use his more general term, autonomic nervous system, he would believe that such a function of the ciliary ganglion would not be in accordance with what is at present known.

A CONTRIBUTION TO THE SURGERY OF CEREBRAL TUMORS.

By George Woolsey, M.D., of New YORK CITY.

The reaction which followed the indiscriminate resort to operation for cerebral tumors, which was stimulated by the publication of the successful cases by Godlee and Horsley, has led to an ultra-conservative attitude toward the operation by most surgeons. Operation in cases imperfectly localized naturally produced discouraging results.

At the outset we must admit that only a small proportion of all cases of cerebral tumor are suitable for radical operative treatment—a proportion which varies from 2 to 8 per cent., according to various neurologists, judged on the basis of the autopsy findings, or runs up to 16 per cent., judged by the histories of those clinically diagnosed. According to Starr, about 7 per cent. of all cases are operable. This small percentage depends largely on our imperfect means of exact diagnosis and localization and on the inaccessibility of certain parts of the brain to successful surgical operation. With the improvements in the methods of cerebral localization and in technique the operation has become safer, its indications have been extended, and the proportion of operable cases is likely to increase to a certain extent. The fact should not be lost sight of that all cases of brain tumor, of whatever variety, are necessarily fatal.

The conservative attitude referred to is illustrated by v. Bergmann, one of the highest authorities on brain surgery, who would limit the surgery of brain tumors to those of the central or motor area, on the ground that an exact diagnosis is possible only in tumors of or near this region. V. Bergmann himself, however, operates on tumors in other regions, as his published cases show, and the unfortunate outcome of many of these cases may be a factor in his ultra-conservatism. My own experience in operations on cerebral tumors and cysts—three for tumors and two for cysts—and my interest in cerebral localization induced me to collect the cases of cerebral tumors operated on (including cysts giving the symptoms of tumor), which have been reported during the past five years (101 cases), with a view to determine whether the results of the more recent operations on cerebral tumors do not

justify a less conservative attitude toward their operative treatment. In this list I have included only those cases reported in the English, French, German, and American literature with sufficient fulness to furnish the data required. Of my own cases two have been shown to the New York Surgical Society, and published in the Annals of Surgery, February, 1903, p. 276, to which reference may be made for details. Similar collections of cases have been made by Knapp, Starr, v. Bergmann, and others up to 1898. The cases reported in the five years since then would indicate whether the improvements in localization and technique justify us in extending the indications as given by v. Bergmann and in taking a more hopeful view of the surgery of cerebral tumors.

As for cerebral tumors in that part of the cerebral cortex accessible to surgical operation, the indications for operation depend entirely upon the possibility of accurate localization. What light does this series of 101 cases show as to this point? I think it shows that, in many cases at least, tumors of the prefrontal, parietal, and occipital areas can be as successfully localized and operated upon as those of the motor area. In this series of 101 cases twelve were localized in the frontal region, four of which really belonged to the motor area, including the posterior parts of the second and third frontal gyri. remaining eight cases (Nos. 11, 43, 71, 72, 73, 75, 77, and 82) were situated in the prefrontal region, and present quite a characteristic group of symptoms for aid in local diagnosis. This area, especially that on the left side, is supposed by many to have to do with the higher psychic powers and the moral sense. From the analysis of 775 cases of brain tumor accompanied by psychic disturbances, Schuster claims that certain psychic symptoms correspond to certain forms and groups of anatomical and local conditions, and that frontal tumors present moral insanity and dementia—and less often hallucinations, paranoia, and mania—more often than tumors elsewhere. Gianelli² says that the more prominent the psychic disorders-torpor, weak memory, etc.—the more likely is the growth to be in the prefrontal lobe, and that seventy-seven out of ninety-seven cases of tumor of the frontal lobe were accompanied by mental disturbance. All of the above eight cases of frontal tumor, irrespective of the side, show psychic symptoms, and two of them moral perversion. L. Bruns³ says that disturbance of equilibrium characterizes tumors of both the frontal lobe and the cerebellum, but a distinct ataxic gait was present in only one of the above eight cases. To assist in the localization, three presented local tenderness on pressure or percussion, one a visible external swelling, two exophthalmos, and in two the eye was lowered and turned out.

Котагкв.	134 years later, apparent slight recurrence.	Only paresis of hand re-	mained. Recurrence; death in three months.	2d wk Death from meningitis.	Shown 51/2 years later; no	recurrence.		Nearly a curc.	No recurrence 8 years after.	Symptoms returned in five months; death 6-7 mos.;	r. hemisphere infiltrated. Tumor subcortien!; interal ventricle opened and	drained. Temporary Improvement;		Left hospital in 8 months.	Recurrence; second opera- tion in 9 months; death a	fow days later.	Cyst partly extirpated; repeated recurrences and operations. Death in 8	s later; hemos d operation t
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Кесоу-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Operator.	Williamson.	±.	Mikulicz.	Riedel.	v. Bramann.	Nedwill.	Kosinski.	Albert.	=	Ewald.	Keen.	R. G. Wilcox.	2		Stratton.	Grlsson.	Lennander.	¥
Variety.	Small round- celled sareoma.	Angloma.	Glioma.	Fibrosarcoma.	Spludle-celled	Hydatid eyst.	Anglosarcoma	Gumma of dura.	Fibroma.	Gllosarcoma.	Sarcoma.	Small round-	Glloma.	*•	Flbrosarcoma.	Cyst.	Cystoglioma.	Spindle-celled sarcoma.
Position.	R. motor area.	L. motor area	(nower party. R. motor area (anter. part).	L. motor area.	R. motor and	R. motor area.	*	L. motor area inf. and ant.	R. motor area.	:	2d l. frontal convolution.	R. motor area.	L. motor area.	R. motor area.	L. motor area.	L. motor area	L. motor area.	R. motor area.
Hend- ache.	+	+	+	ı	+ 2	+ +	+	+	¢	+	1	r. side.	+	+	ı	+	e	+ .
Choked disk.	+	+	late.	ı	+	+2	118 III.	+	~	late.	left.	late.	+ 5	+100	2	ı	1	+
Sox and age.	%.%	₽.8	358	Ä.	348	2∺3	ii.	37.5	M.	%;~	M.	45.K	E 5	iz:	SE 21	M.	##	45.
By whom and where reported.	Ollver and Williamson. Brit Med. Journ., Nov.	zo, rans. Ibld.	K. Bouhoeffer, Monats. f. Psych, u. Neurol.,	Zlehen. Zeits. f. prakt.	Hansier, Archiv. f. Psy-	Nedwill, Lancet, 1898,	Kosinski. Medycyna,	v. Friediander und	Schlesinger, Ibid.	Ibid.	Thomas and Keen. Year Book of Med, and Surg.,	W. C. Kranse. New York Med. Jour., July 30, 1898.	Ibld.	Ibld.	Growley. Trans. Med. Soc., California, 1898,	p. 202. Grissou. Neurolog, Cen- traible 1898, p. 1138	S. E. Hensehen. Mitthell. a. d.Grenzgebiet d. Med. u. Chir., 1898, No. 3.	Ibid.
No.	-	C.)	es	~~!	ı	ဖ	£~	32	G	ខ្ព	=	12	13	14	15	16	12	18

Hernia cerebri; skin grafted; report 4 months	Recurrence; condition hopeless; operation in two	stages for hemorrhage. Recurrence; death in $2\frac{1}{2}$ months; removal incom-	plete. Tumor subcortical in cen- trum ovale; none seen or	tell at operation. Was there a tumor? none	nound. No improvement; was there a tumor? none found.	Worse rather than better.		Recurrence; second operation; death in 2½ years;	operation in two stages. Death 7 mos. after second operation, 10 mos. from	first; tumor subcortical. Agraphia and no aphasia.	Insufficient data for localization; operation on	wrong side. Report 1 year later; operation in two stages; tumor	subcortical.	Death 10 days after second	operation; nothing found. Nothing found.				symptoms; tumor sub- cortical.
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Meyer.	Gerster and Lilienthal.	Nicholl.	Seymour.	Gould.	Kolaczek.			Seydel.	Richardson.	E. D. Ferguson	Lamphear.	Heidenhain.	Czerny.		Jordan.	Czerny.	Anderson.	Cotterill.	ž
Cyst.	Glioma.	Alveolar sar-	Small round-		c	Glioma.	Cyst.	Fibroma of dura.	Sarcoma.	Glioma.	Spindle-celled sarcoma.	Solitary tuber-	Spindle-celled	sarcoma.	6.	Round-celled	Osteoma.	Spindle-celled sarcoma.	Sarcoma.
R. motor area. Cyst	L. motor area.	R. petrous bone pressing on r.	R. motor area.	٠-	••	L. motor area, upper third.	R. motor area, middle third.	L. motor area.	;	2d 1. frontal	R. operculum and insula.	R. paracentral lobule.	R. motor area,	ty raddn	~	R. motor area.	"	•	
+	+	r. side.	+	+	+	1	1	+	+	+	:	ı	+	+	~	+	+	1	1
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38	28. 28.	M.	M. 49.	Ä	15.83	#:I	M. 48	¥Ÿ.	%K	E: 55	M. 24.	äg	¥.	E . C	Z'	Zig	zi:	ž.K	M. 85.
Willy Meyer. Ann. of Surg., 1898, xxvii. 770.	A. Wiener. New York Med. Journ., Oct. 15,		Gordinier. Albany Med. Annals, Sept., 1898.		Liepmann. Monatschr.		E. Hitzig. Mitth. a. d. Grenzgeb. d. Med. u.			Gordinier. Amer. Journ.		Bayerthal. Münch. Med. Woch., 1899, No. 46.		Ibid.	I Ibid.		Handford. Brit. Med. Journ., March 11, 1899.		Ibid.
19	20	21	22	প্ল	24	25	26	27	83	29	30	31	32	33	34	35	36	37	88

	Kemarks.	Some tumor tissue left.		Died next night after tem- porary improvement.	Thin walls of eyst removed	Recurrence in 8 mos., operation; recurred again in	Cyst opened in removing tumor.	Temporary Improvement.			operations; patient finally died. Tumor not found; probably small at operation; dled	In 1,5 years; autopsy. Tumor subcortical.	Died in 3 months; diagnosis by Edinger. Hearing and musical sense in left car	entire temporal lobe. Second operation in a few weeks, and large tumor	removed. Nearly a cure; report years later.	Sight largely restored; at work in a mine 3 to 4 years later.
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- Contract C	Operator.	B. Lange.	Verstraeta.	Marion.	Knott.	Durante.	Keen.	Sherwood.	L. D. Rogers.	White	Krönlein.	Heidenhain.	¥		Ransohoff.	R. Sattler.
	variety.	Spindle-eelled	Fibrosarcoma.	Fibroma.	Cyst.	6-	Endothelloma. Keen.	Fibroma from		Spindle-celled sarcoma.	Spindle-celled sarcoma.	Cystlesareoma	Melanotie ear- einoma.	Spindle-celled sarcoma.	6-	Glioma.
Doction	rosition.	R. motor area.	Median.	R. motor area.	R. motor area (ant.).	R. frontal area	L. parietal lobe.	R. motor area,	L. parietal	L. nucleus eaudatus.	R. motor area.	R. motor and	R. temp. lobe.	Post. inf.angle l. par. bone.	R. motor area.	L. occipit, reg. Glioma.
Head.	ache.	~	1	+	+	+	1. side.	+	+	+	+	+	+	+	+	+
Choked	disk.	ı	1	1	1	+	1	+	+	+	1	+\$	<u>.</u>	left.	1	+
Sex	age.	F. 22	33.	M. 45	ZZ.	20.K	M. 57	F. £	148		Z.	 .:5	ii a	SK.	ZZ ZZ	18.
owna pun mona an		Hoehe. f. Nerv	A. Delobel. Gaz. hebd.	Apert & Gandy, Archiv.	Van B Knott. Journ.	Junite. Brit. Med. Journ., 1909, fl. 1462.	Mills, Spiller and Keen. Journ. Nerv. and Ment.	F. R. Sherwood, Chleago	Steffenson, Med. News,	Hale White, Guy's Hosp. Reports, 1901, Iv.	Krönlein. Centralbl. f. Chir., 1901, Bellage,	Heldenhain. Ibid., p. 42.	Ibid., p. 44.	Clarke and Lansdown. Brit. Med. Journ., Apr.	H. H. Hoppe, Journ. Amer. Med. Assoc., Eds. 9, 1601 p. 209	Ibid 1501, P. 502.
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Tubercle 1/4 in. below bottom of incision, found at	dutopsy. Death from shock; nothing found of coercies	Report 2 years after operation.	Report 9 mos. after opera-	Patient a physician, prac-	Tumor found at autopsy, not felt at operation; frac-	ture 3 months old. Some astereognosis remains	In right name. K-ray examination nega-		Report 3 mos. after opera-	tion. Died in 4 weeks; temporary improvement.	pressure symptoms; opera-	contributive. Condition about the same I month later.	Tumor felt ½ in, below sur- face by needling.	X-ray shadow.	Two stages because of bemorrbage; carotids clamped by Crile's method; X-ray	snadow. Report 3½ montbs later; pulm. tuberc. 5 years ago; operation in two stages;	Symptomatic cure; recurrence; second operation 11	
4, 1			Report	Patien			X-ray			Died in impro	Impro	Condit 1 mon	Tumor face b			Report pulm.	Sympto rence years	c asset
-6 hrs.	same	· • •	:	:	+~	days.	:	+ 6	; ; ;	:	:	:	:	+87	bours 3-4 bours	:	:	
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Ransohoff.		Glass.	J. Bell.	C. A. Wheaton	Montenovesi.	Postempsky.	Durante.	Keen.	*	Warren.	Beach.	Warren.	Porter.	W. J. Hearn.	J. B. Deaver.	Ransohoff.	Durante.	
Tubercle.	Gliosarcoma.	Endotbelioma.	Glioma.	Sarcoma.	Spindle-celled sarcoma.	Glioma.	Fibrosarcoma.	Gliosarcoma.	Sarcoma.	Cyst.	٥٠٠	Old clot.	Glioma.	Fibrosarcoma.	Spindle-celled sarcoma.	Solitary tuber- cle.	Fibrosarcoma.	
R. motor area. Tubercle.	3	2	L. motor area,	R. motor area.	R. insula and corp. striatum.	L. motor reg.	L. motor and	L. sup. par.	R. sup. frontal	E. motor and parietal area.	L. motor area and parietal	R. motor area and parietal	R. motor area.	L. par.reg. and motor area.	R. motor area.	L. motor area.	L. frontal lobe.	
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54 Ibid.	Ibid.	Leszynski and Glass. Med. Record, Sept. 28,	J. Stewart. Amer. Med.,	Dunning. St. Paul Med.	Mingazzini. Deutsche Zeitsch.f.Nervenheilk.,	1901, xix. 1 et seq. Ibld.	Ibid.	C. K. Mills, Phil. Med.	Ibld.	Walton and Paul. Journ. Nerv. and Ment. Dis.,		Ibid.	McCuskcy and Porter, Journ. Amer. Medical Association	0		Ransohoff. Journ. Amer. Mcd. Assoc., Oct. 11, 1902.	Durantc. Brit. Med. Journ., 1902, ii. 1822.	
5-1	55	56	57	58	59	09	61	62	63	64	65	99	67	68	69	29	11	

Marin o pagetime	Remarks.	Symptomatic cure; report 6½ years later; no recur-	rence. Report 6 years later.	Result not given; hemor- rhage severe.	Death from shock; hemor-		ration; X-11ty sharow.	Death due to shock.	Death from hemorrhage.	Died of purulent menin- gitis; tumor only felt when	patient sat up. Right hemianopsia pres- ent.	Report 4 mos. after opera-	Died in 4 months or more; operation palliative;	nothing seen or felt. Recurrence; death 2 years	Result negative; nothing	seen or ieit. Worse ruther than better.	Well 2 years later; died 3	operation; lateral ventriele probably opened.	operation.	after operation; nothing seen or felt at operation.
1	Deaths.	:	÷	:	+4	: :	÷	+	+	15th	aay. 	÷	÷	÷	፥	:	:	:		<i>:</i>
	Im- prove- ment.	:	:	:	:	+	steat.	:	:	:	:	+	+	+	:	:	+	-1		 ŀ
!	Cure.	+	+	:	:	:	:	;	:	:	+	:	:: ::	:	;	:	:			:
	Recov- ety.	+-	+-	¢	;	+	+	:	:	+-	+,	+-	+-	+	+	+	+	-1	- 4	 Ի
	Operator.	Durante.	=	Keen.	2	W. J. Hearn.	v. Bergmann.	:	÷	-	Thiem.	Miles.	Gussenbauer.	z	:	÷		Funke.	Fitch	
	Variety.	Fibrosareoma.	Gumna (sub-	Spindle-celled sarcoma.	Spindle-celled	Gumma.	Angiosareoma	~	Cavernous an-	Round-eelled sarcoma.	Cystic tumor.	Gumma.	Gliosareoma.	Large round-	i i i i i i i i i i i i i i i i i i i	Scienosis of	Gliosarcoma.	Gumma.	£	•
	Position.	L. frontal lobe.	=	L. motor area and 2d front.	convolution L. front, lobe.	L. motor area.	R. front, reg.	L. motor area.	2	:	L. oecip. lobe.	L. prefront.	R. motor area.	L. motor area.	6-4	L. motor area.	R. motor area.	2	:	
	Hend- achc.	٠.	.+	+	+	+	+	:	+:	+	+	+	+	+	+	+	+	+	+	
	Choked disk.	F	+5	double.	+	+	right.	4		right.	right.	+	+ right.	1	+	+ioh+	right.	ı	ı	
	Sex and age.	5.3	M.	zig	E E	Zi.	zżs	¥;	## Z	E.S	M. 38	¥.	z z	N.	zie	iz:	E 23	M.	35	24
the street of th	By whom and where reported.	Durante. Brit. Med. Journ., 1902, il. 1822.	Ibid.	F. X. Dereum. Journ.	1902, p. 347. W. W. Keen. Ibid.	C. K. Mills. Phil. Med.	E. v. Bergmann. Archiv f. klin. Chir., 1902, ixv.	Ibid.	Ibid.	Ibid.	C. Thiem. Centralbl. f. Chir., 1902, Beilage, p.	W. Elder and A. Miles.	Gussenbaner. Wiener klin. Woeh., 1902, p.	1431. Ibid.	Ibld.	Ibid.	Ibid.	Ibid.	Ibid.	
ļ	No.	22	55	7.4	12	5	11	78	73	8	81	85	S	8.	38	98	87	88	83	}

Roport 2 weeks after operation; local tenderness on	percussion present. Last report 1 month after operation; left parietal re-	sonance tympanitic. Improvement jasted 7 mos.; death 7 mos. after opera-	Improvement temporary; death 6 months after first operation; nothing found at first or second opera-	- 111		mains in left hand. Died 4½ mos. after operat'n from infection of persist-	ing sinus; X-ray shadow. Improvement continues	1½ years after operation. Astereognosis present for a time; patient well 8 mos.	after operation; cyst rup- tured spontancously. Improvement marked for a time; died 3½ mos. after			opened and drained; celluloid plate over opening.
:	:	:	:	+,	5 hrs.	:	:	:	:	+8	mours:	
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Gussenbauer.	•	3	3	3	McCosh.	Kiliani.	Woolsey.	2	3	3	æ	
	Cyst.	Gliosarcoma.	Çu	Round-celled	Small round- celled sarcoma.	Gliosarcoma.	Sclerosis of	Fibroma and cyst.	Glioma.	Cyst.	ä	
L. motor area, Necrotic tispost. part. sue.	L. motor area.	R. motor and sup-front. area.	R. motor area?	L. front. reg.	R. motor area.	L. motor area, Gliosarcoma.	L. motor and	R. motor area.	R. occip. lobe. Glioma.	R. motor area.	R. front, reg.	
+	1. side.	+	+	+	+	+	+	+	+	٠,	+	
1	+	+ right	+	ı	+	+	ı	double	tight.	·~-	c~	
M. 53	당음	38.	M.	H.2	유	32.	F. 5	24.6	F.83	F.	M.	
90 Ibid.	Ibid.	Ibid.	Ibid.	Ibid.		Kiliani, Ann. of Surg , April, 1903, p. 610.	Woolsey. Ibid., Feb.,		Ibid. Not reported; see above.	Ibid. Not reported; see above.	Ibid.,	
06	91	35	93	3	95	96	97	98	99	100	101	ł

This series of 101 cases includes five cases of tumor localized in the parietal region and found and removed by operation, besides one imperfectly localized from an insufficiency of focal symptoms. Four of these five cases were localized and reported by Mills, of Philadelphia. All of the five cases presented symptoms of sensory disturbance, and were localized by these symptoms. In four of them these symptoms included astereognosis, which was also present in the case of some tumors in the motor area where the region behind it was invaded. With reference to astereognosis, Walton concludes that "it seems a safe working plan in operable cases with no other localizing symptom than astereognosis to select for the centre of the area to be exposed a point in the ascending parietal convolution at a height corresponding to the motor representation of the extremity involved." In four of the five parietal tumors there were also motor symptoms, usually of moderate development and late appearance, and due to the forward extension of the tumor or its pressure in the course of its growth. Three of the cases also presented ataxia.

Three of the 101 cases were diagnosed and found in the occipital lobe. In all three there was homonymous hemianopsia which, says Bruns, alone or associated with appearances of optic irritation or hallucination or soul-blindness, is characteristic of tumor of the occipital lobe. Schuster says that hallucinations and delirium are particularly frequent in occipital lobe tumors. In one case there was also an external tumor to assist in the localization. Among the 273 cases of operated brain tumor collected in v. Bergmann's work, only three of the occipital lobe are given. As the three cases out of the series of 101 include one of the writer's cases which has not been elsewhere reported, a résumé of it is given:

H. S., female, aged twenty-nine years. Family and previous history negative. No specific disease. One and a half years ago intense right occipital headache, nausea, and vomiting. Later on staggering, but to no particular side. Eyes—left: optic neuritis; right: atrophic disk, total blindness. Left hemianopsia. Patient dull and stupid. Semicoma alternating with delirium. Has had drawing up and twitching of left leg. Pulse rapid, weak, and hardly perceptible. Diagnosis by Dr. E. D. Fisher: Tumor of right occipital lobe.

Dr. E. D. Fisher: Tumor of right occipital lobe.

Operation, June 9, 1897. Right occipital lobe exposed by trephine and rongeur, and explored to falx and tentorium. Brain surface appeared abnormal, darker and yellower than normal, and a section was removed for examination. No limited tumor. Two and a half drachms of clear, straw-colored fluid removed by syringe from right lateral ventricle. Dura and scalp sutured. Primary union. June 25th, great improvement; no headaches, stupor, or delirinm; patient quiet and rational. Discharged improved June 29th. Microscopic examination of specimen shows it to be a diffuse glioma. She died in September, 1897. The operation was merely palliative.

Enough has been said to show that tumors in the prefrontal, parietal, and occipital regions are localizable and operable, and many of the characteristic symptoms of tumors of these three regions which made this localization possible have been given. Moreover, the results of operation on tumors in these regions have been quite as good as on those of the motor area. The number also of operations on tumors in regions other than the motor area has largely increased in the last five years, and we may justly claim that the indications for operation on cerebral tumors should be extended beyond those of the motor region. Although in cases of brain tumor the diagnosis should be made or

Although in cases of brain tumor the diagnosis should be made or confirmed by a skilful neurologist, the surgeon should not be dependent on this diagnosis alone and operate in a mechanical way like a mere mechanic. To obtain the best result and to intelligently meet the demands of the situation in an operation for brain tumor, the surgeon should have a good knowledge of the methods of diagnosis and localization as well as of craniocerebral topography. We may go a step farther and assert with Durante, in presenting a number of operated cases of tumor of the prefrontal region as a contribution to the function and localization of this part of the brain, that the surgeon in operating on cerebral lesions may contribute much to the physiology of the brain as well as to the diagnosis of its lesions. He likens the surgeon to a physiologist performing an experiment in vivo.

In arriving at the diagnosis we must consider (1) the general or pressure symptoms, and (2) the focal or localizing symptoms. Of the pressure symptoms, headache, choked disk, vomiting, and vertigo are the most important. Persistent headache is the most constant. In the above 101 cases its absence was mentioned in only eleven cases, or 10.8 per cent. It is of but little value in localizing the tumor, for it was confined to the same side in only ten cases, or 9.9 per cent. It is noteworthy that in tumors of the frontal lobe the headache, if localized, may be frontal or occipital, or both, as the pressure seems to be exerted in both a forward and a backward direction.

According to Wilder, choked disk is present in 80 per cent. of cerebral tumors (90 per cent. of cerebellar tumors), and it is said that 90 per cent. of the cases of choked disk are due to brain tumor. In the present series, among the ninety-four cases where it was mentioned, it was present in only 69.2 per cent.; but among the twenty-nine cases where its absence was noted nothing was found in three cases, cysts in five cases, sclerotic or necrotic tissue in two cases, tubercle in two cases, a gumma and a very small tumor each in one case. Deducting these fourteen cases, choked disk was present in 84.1 per cent. of the remaining cases. Wilder also says that it is of little value as a localizing sign, and that it does not furnish any information as to the nature or size of the tumor; but Gunn⁸ states that optic neuritis on one side or

markedly prominent on one side points to a tumor of the cerebrum on that side. In sixteen cases (17 per cent.) of the ninety-four it appeared, first, most markedly or only on the same side as the tumor, and in six cases on the opposite side.

In general, also, it is probably true that it is more regularly present and more often pronounced and double in a large or rapidly growing tumor, and more often absent in a cystic tumor. With tumors of the motor cortex double choked disk appears late, and is frequently absent—i. e., in 33 per cent. of cases according to Wilder and in 38 per cent. of my series of 101 cases. Hence in tumors choked disk of the motor area, and especially double choked disk, indicates a large or rapidly growing tumor.

In an analysis of seventy-four cases of cerebral tumor Singer "found the absence of optic neuritis rare in cases under forty years of age, and increasingly common after that." Among the fifty cases under forty years in which choked disk is mentioned, it was absent in thirteen (or 26 per cent.) against 44 per cent. in cases over forty years. Among the thirteen cases just mentioned are nine which we deducted in taking the percentage of choked disk, making choked disk absent in only 8 per cent. of cases under forty years of age.

In the present series of cases vomiting and vertigo were present in a relatively small proportion of cases, 33.3 per cent. and 22.2 per cent., respectively. Still other pressure symptoms occur, such as slow pulse, deep respirations, psychic unrest, or general convulsions; but the decisive pressure symptom is choked disk.

Without going into a discussion of the mechanism of the pressure symptoms and the various theories which seek to explain them, we may say that some of the cases operated upon show the importance of the cerebrospinal fluid as a factor in the pressure symptoms, and thus support v. Bergmann's theory that the increased tension of this fluid compresses the capillaries and causes anæmia, and thus irritation and paralysis of the nerve centres.

While the pressure symptoms, combined with the course of the disease and exclusion, may enable us to diagnose a brain tumor from other brain lesions, they do not enable us to localize it so that we are justified in attempting its removal. An exact localization, says Oppenheim, is necessary for surgical treatment; and "only the relative certainty of the diagnosis gives us the right to do a dangerous operation" is the statement of v. Bergmann. The focal or localizing symptoms, due to the destruction of or the local pressure on some particular part of the brain whose function is known, vary with the position of the new-growth and hence lead to its localization.

There are two other means of localization of brain tumors that may prove of much assistance—percussion or pressure and the X-ray. In

the series of 101 cases collected local tenderness on percussion or pressure over the tumor was noted in twenty-one cases. Two of these were subcortical, including one tubercle, the remaining nineteen cortical or surface growths, including two cysts, three gummata, one case of necrotic tissue, and three cases of painful tumors, appearing on the sur-If percussion or pressure show tenderness locally the tumor is probably superficial.⁵ Macewen has called attention to changes in resonance on percussion over cerebral tumors—i. e., tympanites, increased dulness, and cracked-pot sound—which are of service in localization when circumscribed, and in general diagnosis when more diffuse. In two cases on the list increased dulness was noted, and in one case (No. 51) it was the only marked localizing sign. In two cases there was tympanitic resonance, and in one of these cases (No. 75) also this symptom and local tenderness were the principal localizing signs. cases of difficult diagnosis the local tenderness and percussion note may be even more important than the cerebral symptoms.8 Carson9 reports a case to show that the cranial cracked-pot sound may be a valuable sign of cerebral tumor, and claims that it is due to a separation by pressure from within of the sutures which had previously come together. In one case (No 63), in a child of eight years, there was a cracked-pot sound on both sides. It is to be remembered that changes of the cranial percussion note are present in other conditions than tumors, especially traumatic lesions associated with blood clot. (See also Paoli and Mori, Il Policlinico, February 15, 1898.) In six cases of the series there was an external swelling, three of which were tender to pressure. The X-ray has only lately been tried in cases of suspected brain tumor. In one case of the series (No. 61), a glioma of the motor area, it was negative; while in four others (Nos. 68, 69, 76, and 96), including three sarcomata and a gumma, it was positive. These and a case of glioma of the cerebellum reported by Church, of Chicago, include all the reported cases that I know of where the X-ray was positive. two of these cases the bones of the vault were noted as being very thin. Obici and Bollici¹⁰ demonstrated post-mortem by means of the X-ray a sarcoma of the brain in a boy, proved it by dissection, and experimented on the cadaver. The great importance of attention to special details in this work is emphasized.

For the purposes of operative treatment it would be very desirable to have a still more exact diagnosis, to know whether the growth is cortical or subcortical, and what its size and nature are. It was pointed out some time ago by Seguin and Mills that paresis with predominance of tonic spasm, such as frequent attacks of Jacksonian epilepsy, indicate a cortical lesion, though this symptom is present in a few subcortical tumors. If percussion be very sensitive locally the tumor is probably superficial. In large tumors the symptoms due to pressure are usually

very marked, and the focal symptoms indicate a wide extent of involvement or pressure. Tumors of the motor cortex where double ontic neuritis is marked are probably of large size.

We are still less able to diagnose the nature of the tumor. Pressure symptoms, including choked disk, are probably less common or less marked with a cyst than with a solid tumor of equal size, though it is difficult to diagnose a cyst from a small, solid tumor. Rapidly growing tumors, as indicated by the course of the symptoms, should indicate malignant growths, glioma, sarcoma, etc.; but many of the latter grow slowly, as indicated by the duration of the symptoms in such cases. This is especially true of the fibrosarcomata and spindle-celled sarcomata, fourteen cases of which averaged nearly three years, while the small round-celled variety shows a much shorter duration. We know, too, that the so-called malignant tumors are by far the most common. Thus, in this series of cases, among the eighty-eight cases in which the variety of the tumor was mentioned, forty-four (50 per cent.) were sarcomata (including gliosarcoma), eleven (12.5 per cent.) were gliomata, ten cysts, five fibromata, five gummata, three tubercles, two angiomata, two endotheliomata, two cortical scleroses, and four single examples of other forms. There were also six cases in which nothing was found and six in which the variety was not mentioned.

At times we may diagnose with some certainty a gumma or a tubercle from the previous history or the present condition. We can rarely, if ever, tell whether a tumor is encapsulated or not, though Singer" says that out of seventy-four cases of autopsied cerebral tumors all of the nine which had had no optic neuritis were over forty years of age and had infiltrating malignant growths.

The importance of the accurate localization of cerebral tumors is shown in Van Hippel's statistics, given by v. Bergmann,5 in which out of 116 cases accurately localized the tumor was removed in all, 60 per cent. were improved or cured, and 7 per cent. were not improved or died of the operation. On the contrary, in 157 cases where the localization was defective and the operation was more or less exploratory, 47.7 per cent. died as the result of operation. Out of 111 cases collected by Knapp¹² where the tumor was not found, fifty-eight (52 per cent.) died, and in about 21 per cent. of all operated cases there was a failure to remove the tumor owing to errors in diagnosis.

The indications for operative treatment are clear. A radical operation is indicated in cases where the tumor can be satisfactorily located in a region accessible to surgical operation and when there is no evidence of malignant disease elsewhere, of a very large cerebral growth, or of multiple growths. V. Bergmann is opposed to operation on supposed gummata, Horsley in favor of it, and the weight of evidence is in favor of the latter view. The mortality and results are more favorable with

gummata than with any other form of new-growth. Moreover, other forms of tumor may occur in those giving a syphilitic history, as occurred in at least one of the appended series of cases, and a gumma may occur when no history of syphilis is obtainable; so that we cannot be sure of the nature of the growth until we have exposed or, perhaps, even examined it. Although antisyphilitic treatment may temporarily improve the symptoms due to a gumma, and even those due to other forms of tumor, it probably rarely, if ever, causes the entire absorption of the gumma, so that an operation is the only sure radical cure.

Solitary tubercles have also given good results, Horsley's and other cases having remained well five to seven years.

Opinion is divided as to palliative operations, but personally I think they are strongly indicated where the tumor is not to be localized or is inaccessible, in order to relieve the symptoms most complained of—headache, loss of vision, etc.—when these are pronounced. Such operations are comparatively safe. Knapp¹² gives 14 per cent. of mortality in sixty-eight cases, and I think this figure is too high for the present results. The temptation to make such an operation a thorough exploratory one should be resisted, for the weight of opinion is against exploratory operations.

The prognosis is hard to give in advance, so much depends upon the conditions found. It should never be lost sight of, that all cerebral tumors, even the most benign, are necessarily fatal if nothing is done for The mortality, according to the statistics of Chipault and of Starr, is about 56 per cent.; the tables of Knapp make it 43 per cent. before 1891, 33.4 per cent. from 1891 to 1898. In 1899 v. Bergmann found that 25 per cent. of cases died as the direct result of the opera-The improvements in localization and operative technique have reduced the mortality of cases operated on in the last five years. the series of cases I have collected, twelve cases (11.8 per cent.) died within twenty-four hours and twenty-six (25.7 per cent.) within three If we select the eighty-eight cases where an exact localization was made, the mortality was somewhat less-22.7 per cent. as against 46 per cent. among those not exactly localized. In the table are twelve cases of Gussenbauer's, with only one death, and that due to pneumonia. As to the more remote prognosis, six died between three weeks and three months, nine between three months and one year, and three between one and two years. As almost all of these died from the effect of the tumor, the mortality within two years is 43.5 per cent. This probably does not represent the actual more ity within this period, for a large number are reported within a comparatively short time after the operation—in one case only two weeks.

In spite of the high mortality we must admit that the immediate and remote mortality is no greater than follows radical operation for malig-

nant growths in some other situations. When we consider the otherwise hopeless condition of these cases, the difficulties of exact diagnosis. the inaccessibility of the tumors, and the marked relief of symptoms in almost all cases not dying at once, we may take courage and feel some degree of satisfaction. When we look at the other side of the question —the length of time during which some cases remain free of recurrence -we may feel still more encouraged. Cases of sarcoma are reported four years four years and one month, five and one-half years, and eleven years after operation. The last case—one of Durante's—then recurred, was again operated and was well six and one-half years later. A case of fibroma was reported well eight years, cases of gummata two and two and one-half years, a case of glioma three and one-half years, and one case, in which the variety of tumor was not given, nine years after the operation. Seven cases of sarcomata are reported to have recurred at periods ranging from three months to eleven years, and averaging two years and four months or, exclusive of the latter case. nine and one-third months.

Gussenbauer¹³ says that in gliosarcomata the prognosis can be made only with great reserve even when removal is apparently within normal In one of his cases recurrence was first evident after three vears. McCosh removed a brain tumor, pronounced fibroma by the pathologist, which recurred as a sarcoma in a few months. the remote prognosis of malignant tumors anywhere is not good at best, especially when not encapsulated: so that the above results are far from discouraging. At least we do not have to fear glandular metastasis in the malignant tumors we meet with in the brain. In reference to recurrence, v. Bergmann says that among the tumors which grow in the cortex, and can therefore be reached by the knife, those are most frequent which promise favorable results from an operation, viz., tough fibromata and sarcomata which are well encapsulated, have their seat of predilection in the gray matter of the cortex, and, when once removed, do not seem to recur.

The prognosis of cysts should not be given without reserve. My first case, operated in 1893, is an example of this. K. R., female, aged eighteen years; fracture of right temporofrontal region at two and one-half years, followed by three operations. At seven years Jacksonian epilepsy on left side, with aura in left hand extending to left foot; tremor of left extremities. Operation: right motor area exposed, and appeared normal; old scar and gap in bone exposed; cyst opened leading back to beneath motor area; drainage; four hours later collapse; temperature 104° F.; stimulation and reaction; unconsciousness; temperature rose to 108° F.; death in thirty-six hours; no autopsy; no apparent infection. Without particular care there is always the danger of infection in a cyst as long as drainage is employed. As to the remote

prognosis of cysts, v. Bergmann says that traumatic cysts are not common and of small size, and that brain cysts more often occur in sarcomata of the brain from the softening and breaking down of nearly the entire tumor. When the fluid of a brain cyst is rich in albumin, and the cerebrospinal fluid from a lumbar puncture is poor in albumin, the cyst is always one derived from a sarcoma. In a case of Vallor the sarcomatous nature of the cyst was first known after three years.

In the evolution of the technique the operation of craniectomy for the exposure and removal of cerebral tumors has undergone many changes and great improvements, with a resulting lessening of the mortality. It is significant that infection was the cause of death in but two cases on the list. Trephining and enlarging the opening by the rongeur was too slow, and if a sufficient exposure were obtainable an unpleasantly large opening was left in the skull. The Wagner osteoplastic flap was a great advance, and revolutionized cerebral surgery, for a large area is rapidly exposed for examination, plenty of space is afforded for operation, and by replacing the flap the objection of leaving a large, uncovered area of brain is obviated. But here, too, the chisel and mallet were somewhat slow and theoretically liable to cause concussion, though I have not found it so in practice. Mills14 says it is of the utmost importance that some speedier method of opening the skull, and some method accompanied by less cranial concussion, should be employed. In my last two cases I have employed with satisfaction Doyen's electric circular saw. A small opening is rapidly made with a burr at each angle of the quadrilateral flap, the thickness of the skull is measured at these openings, and a collar of such a size adjusted on the saw that the latter will not quite cut through the inner table. The latter is broken by the blow of a chisel with a probe-pointed lower angle, and the flap is raised up, breaking the base as a hinge for the flap. This fracture may be facilitated by sawing partly through from beneath with a Gigli saw, and the latter may be used for the entire sawing required, but it takes considerably longer. If one uses the Gigli saw slowly no protection of the dura is necessary. I have had no experience with the Stellwagon trephine, but it does not seem to have fulfilled its promise.

Hemorrhage is an important factor in these operations, and I am convinced that it is the chief cause of shock in the surgery of cerebral tumors. In two or more cases in the series death was directly attributed to it, and in at least four cases the operation was done in two stages on account of hemorrhage.

It is naturally free from the scalp, and sometimes unusually so. I have often controlled it by elastic tubing drawn tightly around the head above the eyebrows and ears, or, when this fails, by temporary overlapping interrupted silk sutures below the base of the flap, and

above it if necessary. Continued oozing from the cut surface of the bone may be controlled by pressure with or without the use of Horsley's powdered wax, pressed into the diploë. If we minimize the hemorrhage in the first part of the operation I think it will seldom be necessary to follow Horsley's advice to operate in two stages, going as far in the first operation as raising the bone flap. After losing a case from hemorrhage, v. Bergmann advises this plan when the first stage of the operation causes symptoms of collapse. This was practised in at least four cases in the series of 101 cases, and in one case (No. 69) at the second operation Crile's plan of temporarily clamping the carotids was employed.

The flap of dura, cut about one-quarter of an inch from the bony margin, may be turned back in the same or, according to Keen, in the opposite direction to the bone flap. The stage of approach to the cortex is now finished, and if the tumor is in or on the cortex its removal is usually a simple matter. After incising the pia about them, most tumors—unless disseminated or not encapsulated—are best shelled out with the finger. If nothing is seen on the cortex, the tumor, if present, must be subcortical, and to find it we first palpate the surface exposed. If we cannot feel it, v. Bergmann advises raising the patient to a sitting posture, whereupon the tumor may become visible or palpable. the area exposed sinking in somewhat from the atmospheric pressure in connection with the lessened blood pressure. This plan was successfully used in one case (No. 70) by Ransohoff. If this fails, electrical stimulation may be and has been used to exactly locate the explosion centre of the Jacksonian attacks. Singularly enough this not infrequently gives no muscular contractions, a fact explained by some by supposing that the deep anæsthesia inhibited them; but the same result has been obtained when the patient was allowed to partly come out of the anæsthesia.

If this means fails, then, locating the centre of the area involved, as indicated by the diagnosis, as accurately as possible from the landmarks of the exposed area, we may make a small anteroposterior incision through the cortex and explore with a probe, grooved director, aspirating needle, or the little finger. The first three may be carefully introduced in various directions. Unless we have a positive result with the X-ray, we would not be justified in going any farther. The above exploration is proper and indicated in cases confidently localized; contraindicated in those that are not. An example of a spontaneous disclosure of a tumor and cyst was presented by my last case operated upon (No. 98), where on laying back the dural flap the brain protruded very prominently, its cortex ruptured and opened a subcortical cyst, which forcibly evacuated itself on account of the increased pressure. On enlarging the opening I enucleated a tumor, a fibroma, by means of the

finger, from the mesial wall of the cyst. (See Annals of Surgery, February, 1903, p. 276.)

Bleeding from the cavity left by the tumor should be controlled, as far as possible, by ligature or gentle packing. I believe in always leaving a drain, at least of folded rubber tissue, through the sutured dura to give outlet to the oozing; otherwise the bleeding, which may start afresh, may work its way into the surrounding brain tissue, like a cerebral hemorrhage, or between the dura and brain, and thus add to the area of brain substance destroyed or cause cerebral compression. The drain may be removed in forty-eight hours.

I have never had any trouble from hernia cerebri, though it is still a not uncommon complication, due, in many cases at least, to lack of drainage or to infection. Suture of the pericranium and scalp, allowing for free drainage, completes the operation.

In palliative operations, and where the tumor cannot be found, the bone should be removed from the flap to relieve the increased intracranial pressure and the symptoms due to it, introducing rubber tissue or, better still, a thin plate of celluloid, to prevent union of the scalp and dura. In a considerable number of flap operations for various purposes I have had no failure of union of the bone flap.

The results vary from a nearly complete cure to the relief of the distressing pressure symptoms, and in a few cases no improvement whatever has been noted (6 out of 101).

Absolute cure or restitutio in integrum is rarely, if ever, to be expected on account of the necessary damage to the brain substance by the tumor and the operation of enucleating it; still, in 16 out of 101 cases (including my last case) the symptomatic result was so good as to be considered a cure, and in forty-one cases the result has been improvement, often so marked as to be nearly a cure.

In spite, then, of the small percentage of operable cases, the difficulties of diagnosis, the uncertainty of prognosis, the fairly high mortality, the liability to recurrence, and the difficulties of the operation, and in view of the results obtained and the fact that even benign cerebral tumors are necessarily fatal, I think that the radical operation is justifiable and indicated in selected cases, and the palliative operation in another group of cases of cerebral tumors.

I would like to emphasize the following conclusions:

- 1. The sphere of operation for cerebral tumors may be and has been extended to those parts of the cortex where tumors are accessible and localizable—i. e., to the prefrontal, parietal, and occipital regions, in addition to the motor area.
- 2. The prognosis, both immediate and remote, is as good as or even better than in operations for malignant growths in some other locations.
 - 3. This prognosis has improved with the improvements in localization

and operative technique, and with the limitation of the radical operation to cases accurately localized.

- 4. The palliative operation is strongly indicated to relieve symptoms where localization cannot be accurately made or the tumor cannot be The exploratory operation is contraindicated.
- 5. Practically all circumscribed growths of moderate size are suitable for operation.
- 6. The osteoplastic method should be employed and the most rapid and perfect technique adopted which the circumstances allow.

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MULTIPLE SCLEROSIS WITH DEMENTIA: A CONTRIBUTION TO THE COMBINATION FORM OF MULTIPLE SCLEROSIS AND DEMENTIA PARALYTICA.*

By J. RAMSAY HUNT, M.D., (OF NEW YORK)

INSTRUCTOR IN NEUROPATHOLOGY IN THE CORNELL UNIVERSITY MEDICAL SCHOOL: NEUROLOGIST TO THE CITY HOSPITAL; ASSISTANT PHYSICIAN TO THE MONTEFIORE HOME.

Introduction. Disseminated sclerosis of the central nervous system is generally accompanied by slight mental changes. In the larger number of cases the psychical alterations are insignificant, of mild character, and playing a minor rôle in the list of symptoms. may be summed up briefly as follows: mental dulness and apathy; mild states of exaltation or depression and emotional instability; undue mental complacency and contentment.

With the progression of the affection and the increase of the general symptoms the mental impairment suffers still more, so that in the later stages a partial dementia is not uncommon.

Another group of cases with the somatic symptoms of disseminated sclerosis is characterized by a preponderance of the mental symptoms,

^{*} From the Pathological Laboratory of the Cornell University Medical School.

these appearing early in the course of the disease, of unusual severity, and terminating in complete dementia.

This group is represented pathologically by two subdivisions:

- 1. An extreme development of the sclerotic process in the gray and white matter of the brain (cerebral type of disseminated sclerosis).
- 2. A mixed or combined form. Dementia paralytica and multiple sclerosis occurring in combination.

Both are very rare. The following case represents the combination form of the two diseases:

SUMMARY OF CASE.* A woman, aged fifty-three years, presenting the symptoms of multiple sclerosis followed by dementia: spastico-ataxic gait; nystagmus; ataxic and intention tremor of arms; impulsive laughter; syllabic speech; double optic neuritis; progressive mental enfeeblement, terminating in dementia; duration, eight years.

Autopsy. Thickening of the calvarium; opaque and thickened meninges; marked atrophy of the frontal lobes; granular ependymitis; dilatation of the ventricles; disseminated plaques of sclerosis in the

brain, cerebellum, pons, medulla, and cord.

Histological characteristics of general paralysis and disseminated

sclerosis.

Clinical Notes. R. M., aged fifty-three years, was admitted to the Montefiore Home for Chronic Invalids October 2, 1896. She was the mother of seven children, two dying in infancy of negative causes. No miscarriages; no history of a syphilitic affection was obtainable. Her symptoms date back four years, and had followed an exposure to cold, beginning with uncertainty and weakness in the legs, which had grown progressively weaker.

Her memory is very defective. This with considerable mental

enfeeblement render an accurate previous history impossible.

On admission patient was awkward in all her movements; gait spastico-ataxic; pronounced static ataxia both with open and closed eyes; ataxia and weakness of both upper extremities; right hemiparesis; speech stammering and syllabic; impulsive laughter; facial expression one of stupid hilarity; sight subjectively not impaired; examination of the internal organs negative.

Ophthalmological Examination. (Dr. Oppenheimer.) Double optic

neuritis passing into atrophy.

Note, June 14, 1897. (Examination by Dr. Joseph Fraenkel.) Patient is good-natured, complacent, and inclined to hilarity; complains of occipital tenderness and pains in the upper and lower extremities. Subjectively vision is not impaired. General paræsthesia (numbness and pricking), especially in the extremities. Pupils are small; all reactions present. The lateral excursions of the eyeballs are somewhat limited. Distinct lateral nystagmus.

The lower extremities are paretic, and passive movements encounter resistance. Ataxia and awkwardness of both upper extremities, espe-

cially the right.

No objective sensory disturbances.

^{*} Presentation of Clinical History and Specimens at a meeting of the New York Neurological Society, February 4, 1902.

The jaw-jerk and the tendon-jerks of the upper extremities are wanting. The knee-jerks are lively and equal on the two sides. Ankle-jerks feeble on both sides and easily exhaustible.

Epigastric and abdominal reflexes absent; no involvement of the

sphincters.

Note, June 25, 1899 (Dr. Fraenkel). Patient good-lumored, silly, hilarious. Memory very poor. Says she has never been ill in her life. Extreme mental deterioration. Speech is stammering, with now and then a trace of syllabification. She can neither walk nor stand, and a change of position in bed is effected with great difficulty. Lower limbs are held in a state of flexion. Occasional involuntary atactiform movements of the arms and head.

The eyeballs are constantly dancing, and all movements except downward are accompanied by nystagmus. Pupils of equal size, well shaped, and the reactions to light and accommodation are present. Examination of the vision is unsatisfactory, but no serious defect is present. Sense of smell and hearing are apparently preserved. Motor cranial

nerves are normal.

The arms are weak, especially the right. No atrophy. Marked inco-ordination on both sides. On lifting a glass of water to the lips a typical intention tremor is elicited. Tendon reflexes not elicitable.

No objective signs obtained.

The lower extremities are paretic and held in semiflexion. Of good volume. No resistance to passive movements; on the contrary, a slight degree of hypotonia exists. Slight hyperæsthesia; otherwise sensation normal. The right knee-jerk is lively; the left absent. The right ankle-jerk is present; the left absent. Plantar reflex is present on the right, absent on the left.

The muscles of the trunk are normal. Epigastric reflex absent. Electrically the muscles of the legs present sluggish faradic response. Reaction to the galvanic current normal. Died December 28, 1900.

Post-mortem Examination. The autopsy was performed December 29, 1900, by Dr. Harlow Brooks. A small tuberculous focus in the left apex. Purulent bronchitis. Interstitial nephritis. On removing the calvarium the auterior portion corresponding to the frontal lobes was found considerably thickened and eburnated, measuring from one-half to three-quarters of an inch. The inner surface of this thickened area is uneven, presenting nodular outgrowths and irregularities. The dura mater is normal. Moderate hydrocephalus externus ex vacuo. The leptomeninges are opaque and thickened, especially over the anterior aspect of the brain.

The convolutions of the frontal lobes are narrow and atrophic, the fissures wide and flaring. The whole anterior half of the brain, including the frontal and parietal lobes, appears small and compressed in contrast to the posterior portion. The ventricular cavity is enlarged. Moderate granular ependymitis. The vessels of the circle of Willis

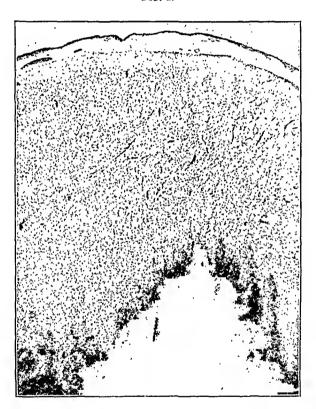
are free from arteriosclerotic changes.

After treatment with Müller's fluid the brain and cord were divided into serial segments for the demonstration and localization of plaques of sclerosis. Yellowish plaques of sclerosis sharply demarcated from the normal brain substance were found in the centrum semiovale on both sides in the cerebral cortex and in the cerebellum. These with the exception of a more diffuse sclerosis of the walls of the posterior

horns of the lateral ventricles were small and insignificant. Plaques were also present in the pons and the medulla bordering on the fourth ventricle and dipping down along the raphe. The plaques in the cord were very numerous, chiefly in the cervical and dorsal regions, including both the gray and white matter, with a predilection for the posterior and lateral columns. A few scattered foci were also present in the lumbar cord.

Microscopic Examination. Brain: The cortex is the seat of extensive changes; the cellular elements are tightly packed together and the glia cells are increased. The normal markings of the cortex are effaced. Many of the ganglion cells are sclerosed and atrophied. In many areas





Frontal lobe. Showing loss of the cortical fibre-system. Weigert's method.

the leptomeninges are thickened and infiltrated with round cells. The cortical arterioles are thickened, with increase of their nuclei, and the capillaries are increased in number.

The perivascular and pericellular spaces are enlarged, many enor-

mously so, containing pigment, fat-granules, and detritus.

By the Weigert method a considerable loss of the radiating and association fibres of the cortex was demonstrable in the frontal, temporal, and occipital lobes. (Fig. 1.) In these areas the tangential fibres were absent.

In the Rolandic area, however, the cell changes were less intense, the medullary network better preserved, and the tangential fibres were demonstrable. (Fig. 2.) No excess of pigmentation of the cells was noted, and the corpora amylacea were few in number. The cortical vessels were thickened and increased in number, but no widespread

vascular or perivascular inflammatory process was noted.

Cord: The plaques of sclerosis in the brain and cord were composed of a dense network of glia cells and fibrillæ, either matted together in a dense network or arranged in rows and whorls. In these areas when dense the medullated nerve fibres had disappeared. By special stains (Mallory and Van Gieson) many naked axis cylinders were found present.

On the periphery of many of the plaques tongues and prolongations composed of glia cells radiated into the normal cord substance. The vessels in the sclerosed areas were considerably thickened, and the ad-



Fig. 2.

Rolandie area. Cortical network well preserved. Weigert's method.

jacent pia mater was thickened and occasionally infiltrated with round cells. The ganglion cells were of normal configuration and structure. The anterior and posterior roots were normal. Except the moderate round-cell infiltration of the meninges bordering the foci of sclerosis, there were no evidences of an exudative or myelitic process.

By the Weigert-Pal method the sclerosed areas were white and sharply defined, as if cut out with a knife. (Figs. 3 and 4.)

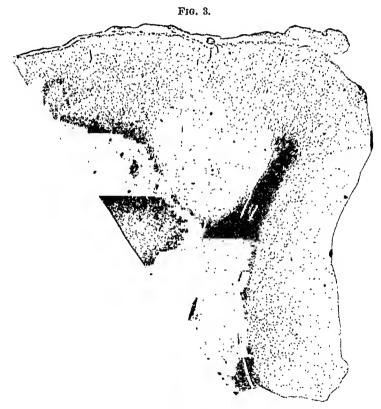
By the Marchi method the sclerotic foci were found free from myelin

globules or granule corpuscles.

In portions of the cord not the seat of sclerosis many fibres showed the characteristic reaction, staining intensely black. In other fibres this degeneration was only partial, a semilunar or concentric ring enclosing a normal axis cylinder. These fibre degenerations were diffuse and nowhere limited to the tract systems.

In the midlumbar region symmetrical patches of sclerosis occupy the tips of both posterior horns, on one side encroaching on the tract of Lissauer and the posterior root zone (anatomical explanation of the absent knee-jerk and Achilles jerk on the left side). The cauda equina was normal. There were no systemic degenerations in the long tracts of the cord.

Optic Nerves and Chiasm: Transverse section of the optic nerves just below the chiasm revealed numerous islets of sclerosis, most numerous in the central portions of the nerve. The nerve sheath is moder-



Rolandic area. Sclerotic plaque. Weigert-Pal method.

ately thickened. The islets of sclerosis consist of a much thickened bloodvessel wall, considerably diminishing the calibre of the lumen and a dense perivascular sclerosis. Surrounding and radiating from this as a centre is a fine glia network. In and around these areas the nerve elements are absent or diminished in number (Weigert method).

No round-cell infiltration or other evidences of recent inflammation were discoverable. Numerous amyloid bodies. The centre of the nerve fibre appeared pale in comparison to the deeply stained periphery by the Pal method, but the evidences of nerve atrophy were moderate. The same changes—vascular sclerosis and perivascular gliosis—were noted in the nasal portion of the optic tracts as they merge into the

commissure. No sharply defined plaques of sclerosis homologous to those found in the brain and cord were noted.

The following is a list of the recorded cases of the combined form of the two diseases, with abstracts of the clinical histories and pathological findings. There are seven cases in all, six with autopsy:

Case I. (Schultze').—Man, aged thirty-six years. Syphilitic infection. December, 1876, onset with frontal headaches, pains in the extremities, and intention tremor. Diplopia; paræsthesia in the arms



Sclerosis bordering lateral ventricle. Weigert-Pal method.

and legs. Severe vertiginous seizure in June, 1877. Later, epileptiform convulsions. Paresis of right arm. Pupils unequal; good reactions. Weakness of vision without objective findings. Transitory aphasic attacks. Appearance of mental symptoms in October, 1878: Delirious, screams, strikes those about him; later, delusions of grandeur, followed by apathy, progressively developing stupor. Hæmatoma auris. Died December, 1878.

Pathological Findings. Marked atrophy and narrowing of the convolutions of the brain. Dilatation of the ventricular cavity. Epen-

dyma granulations. Systemic degeneration of the pyramidal tracts and columns of Goll. Multiple disseminated plaques of sclerosis in cord. Uniform thickening of the walls of bloodvessels and increase of

the connective-tissue elements throughout the brain and cord.

Case II. (Claus²).—Man, aged twenty-three years. Grandfather insane; father a tabetic. Early symptom, uncertain gait. Diminution of sight and hearing, followed by evidences of meutal change. Articulation disturbed, but speech not scanning. The ataxia increased. Remittent paralysis of the legs. Progressive mental deterioration. Diagnosis: general paralysis of the insane.

Autopsy. Thickening of pia arachnoid, especially over the frontal and parietal lobes. Stripping the pia over this area attended by loss of substance. The frontal convolutions are narrow and atrophic, fissures flaring. Dilatation of the ventricular cavity.

patches of sclerosis in the brain, brain stem, and cord.

Case III. (Siemens3).—Woman, aged twenty-two years; single; hereditary taint; venereal infection. Admitted to the asylum in the summer of 1876 with acute mania. During this attack, which lasted six months, it was noticed that the legs were handled clumsily. Later, mental enfeeblement, scanning speech, intention tremor, and ataxia. No nystagmus. Epileptiform attacks of short duration. In July, 1878, a relapse of the mania, lasting four months, followed by dementia. Pupils not mentioned.

Leptomeningitis and atrophy of the frontal convolutions. Partial sclerosis of the cerebellum. Disseminated plaques of sclerosis

in the cord, none in the brain.

Case IV. (Zacher4).—Man, aged fifty-three years. In the autumn of 1878 a fall, followed by headaches and backaches. A few months later excitable and irritable. Failure of memory. Admitted to the asylum July, 1879. Pupils unequal; reactions present. Articulation Ataxic gait. Sensation normal. Knee-jerks +. Marked dementia. Delusions of grandeur. Intention tremor. Speech inarticulate. Marked tremor of body.

Atrophy of convolutions, especially over frontal lobes. Ventricle dilated. Vessels of cortex are increased in number. Walls

Multiple plaques of sclerosis in the cord.

Case V. (Otto5).—Man, aged thirty-five years. Onset with progressive amblyopia, weakness and uncertainty of legs. Later, ataxia of arms and legs. Optic atrophy. Nystagmus. Scauning speech. Increase of the tremor and ataxia. Exaggerated tendon reflexes. Disturbance of the tactile sense. Duration of the above symptoms eight years, followed by progressive mental failure terminating in dementia. Duration of the disease, twelve and a half years. Pupils equal and reactions present throughout.

Autopsy. Pachymeningitis interna hemorrhagica over the frontal region. Pia arachnoid thickened. Marked atrophy of the couvolutions of the frontal and parietal lobes. Numerous foci of disseminated sclerosis in the brain and cord. Sclerosis of walls of ventricle of carti-

laginous consisteucy.

Case VI. (Otto5).—Mau, aged twenty-seven years. Early symptoms: Vertigo, headache, and dimness of vision. Later, ataxia, nystagmus, intention tremor, scanning speech. Failure of memory. Dementia.

Autopsy. Thickening of the skull over the frontal region. Atrophy of the convolutions. Disseminated plaques of sclerosis in the brain, stem, and cord.

CASE VII. (Petroff 5). - Without autopsy.

Clinical Study. Dementia paralytica and multiple sclerosis. Man, aged forty-seven years. No alcoholic excesses; no syphilis. Onset October, 1896, following a fall. Difficulty in articulation. Occasional attacks of mental confusion. August, 1899, ataxia and intention tremor of the arms. Walking almost impossible. Tendon reflexes exaggerated. Speech scanning. Mentally confused and dull. Incontinence of urine and feces. Can neither stand nor walk. No nystagmus. Optic disks normal. In January, 1900, attacks of depression and excitement. Tremulous speech. Tremor of the tongue and face. Ankleclonus. Pupils normal. In August, 1900, delusions of grandeur. He is the Kaiser, has much money, is wealthy, etc. Dementia is pronounced. Speech disturbance is a combined scanning with a silben stolpern.

REMARKS. The present case is put on record as representing the combination form of the two diseases, multiple sclerosis and dementia paralytica.

Although the symptoms of disseminated sclerosis were not apparent until the forty-fifth year, the cerebrospinal distribution of the lesions and their macroscopic and microscopic features were identical with those of the juvenile form, while the extent, character, and severity of the cortical degenerative process would correspond only to that observed in general paralysis of the insane.

Premature senility might be suggested as a possible basis for the mental symptoms and cortical atrophy.

The age of the patient (fifty years) almost precludes this theory. Premature senility is, however, rarely observed; but even this unusual occurrence could be excluded by the absence of the usual senile changes in the brain—i. e., arteriosclerosis of the circle of Willis, encephalomalacia, pigmentation of the ganglion cells, corpora amylacea.

Diagnosis. The diagnostic difficulties encountered in such cases are considerable.

In the earlier stages of multiple sclerosis and dementia paralytica a certain resemblance is not infrequent, as many of the symptoms are common to both. Thus apoplectiform and epileptiform attacks occur frequently in both affections.

Systemic degenerations in the posterior and lateral columns, so frequent in paresis, produce symptoms similar to those following a development of plaques in the same areas.

The nystagmus, scanning speech, and intention tremor when typically present leave no room for doubt.

But these important symptoms of multiple sclerosis are sometimes absent, or occurring in an atypical form may simulate the hand tremor and speech disturbance of paresis. On the other hand, typical nystagmus and intention tremor are rarely observed in paresis.

The Argyll-Robertson pupil if present may justly be interpreted to indicate paresis—with some reservation, however, as this symptom is rarely met with in multiple sclerosis. Uhthoff in an analysis of one hundred cases of sclerose en plaques found the Argyll-Robertson pupil once, and in four cases myosis with sluggish light reactions. In well-marked cases of either affection errors in diagnosis would hardly be possible.

When the two diseases are combined the diagnostic difficulties offered are very great. In none of the recorded cases with autopsy was the combination form recognized clinically.

Usually in the earlier stages the condition was diagnosed as multiple sclerosis, but with the advancement of the mental symptoms the diagnosis of paresis was substituted.

It has happened that the clinical picture from the first has been that of paresis, the plaques of sclerosis being unsuspected until demonstrated by autopsy.

Cerebral Type of Multiple Sclerosis. In the advanced cases of pure disseminated sclerosis the lighter grades of dementia are not uncommon; this is usually attributed to an increase of the sclerotic process in the brain.

Some cases show early in their course symptoms of mental failure which advances rapidly to complete dementia. This is caused by a rapid extension of the sclerotic process in the brain (cerebral type of multiple sclerosis).

In such cases hallucinations, delusions, maniacal outbursts, attacks of melancholia, and delusions of grandeur are not uncommon. Here the pathological lesion consists of an extensive dissemination of the plaques in both the gray and white matter of the brain coupled with more diffuse sclerotic changes. Cases of this description are not common, and have been recorded by Schüle, Jolly, Greiff. Cases somewhat similar, but differing in that the sclerosis was diffuse, involving the brain in toto, have been recorded by Kelp¹¹ and Schüle. 12

Cortical Gliosis; Optic Atrophy; Posterior Column Degeneration. Another group of cases described by Fürstner and Stuhlinger¹³ is of interest as bearing on the types under consideration. Their description is based on four cases having a similar pathology and symptomatology.

The essential pathological change consists in a diffuse gliosis of the marginal layer of the cortex. The glia proliferation is not confined strictly to this layer, but projects above the surface as small, rounded prominences (granula and tubera), and dips down into the second and even third layer of cells.

The tubera often contain small cysts, and minute depressions are vol. 126, No. 6.—DECEMBER, 1903. 64

seen in the cortex as a result of this cystic degeneration. The gliosis is more pronounced over the frontoparietal regions of the brain.

The cells of the cerebral cortex are fairly well preserved; where the process dips down among them they are compressed and undergo atrophy. The overlying pia is sclerosed and the skull is thickened.

In addition to the cortical changes, in all the cases there was optic atrophy and systemic degeneration in the posterior columns of the cord. The authors refer the gliosis to lymphocytes originating from the bloodyessels.

In all the cases an hereditary taint was traceable, with evidences of a defective nervous system in early life (imbecility, intellectual weakness, and in one case epilepsy).

In two of the cases the symptoms of amaurosis and tabes preceded cerebral symptoms by a considerable time.

The speech disturbance resembled that of paresis with a scanning element. Facial, tongue, and hand tremors were present.

Mentally the picture was that of a progressive dementia, lacking the intensity, however, of the paralytic dementia.

Although this condition clinically would simulate most closely a dementia paralytica complicated by tabes and optic atrophy, it might well resemble the groups of cases under discussion, and deserves to be recalled and emphasized in this relation.

To summarize briefly, a clinical picture characterized by a progressive mental enfeeblement, manifesting during its course other symptoms of mental alienation, as mania, melancholia, hallucinations, and delusions, and accompanied by the somatic signs of multiple sclerosis, may be caused by the following pathological changes:

An extreme cerebral manifestation of the sclerotic process, of the same nature histologically as the disseminated plaques in the cord.

A combination of the two diseases, general paralysis of the insane and multiple sclerosis, in the same subject.

The diffuse gliosis of the cortex with optic atrophy and degeneration of the posterior columns also arises for consideration in the differential diagnosis.

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TUMORS OF THE SIGMOID FLEXURE.1

By Prof. C. A. EWALD, OF BERLIN UNIVERSITY, GERMANY.

For a long time my attention has been directed to tumors situated in the left iliac fossa—that is to say, of the sigmoid flexure—because occasionally there are to be found in this region palpable tumors the character of which is not easily recognized. May it therefore be permissible to give you a general review of tumors of this region? The most frequent occurrence of such tumors, which are fecal accumulations. present but small difficulty in diagnosis. They are easily recognized because of their comparative softness and because they not only occupy the descending colon, but also the rectum, where they may be easily felt by the examining finger. If in all doubtful cases you make repeated examinations after having thoroughly cleansed the bowels by laxatives or enemata, you will probably not be subjected to mistakes. The diagnosis becomes much more difficult with the continuous presence of a tumor. We must take under consideration intra-intestinal and extraintestinal tumors, which may arise either from the pelvis, peritoneum, retroperitoneum, or the genito-urinary organs. The tumors may be new-growths, hard, or may be brought about by inflammatory swellings or by an abscess.

Of the solid tumors the most frequent are the carcinomata of the sigmoid. I say of the sigmoid, because I will only speak of the carcinomata confined to the sigmoid flexure and not of those of the rectum, which may extend upward. The recognition of the latter is not difficult when the physician, as a duty, will examine the rectum in every case where the symptoms point to disease of this part. It is not necessary for me to emphasize the latter point before you, members of this society, but rather to the general practitioner who frequently fails to These cases are common enough where patients for a long time complain of dyspeptic symptoms and so-called hemorrhoidal bleeding, without the attending physician deeming it worth while to make

¹ Read before the American Gastroenterological Association, at Washington, May 14, 1903.

either a digital or speculum examination of the rectum. On this account patients are treated for a considerable time with different drugs and the best time for operation is lost.

Not long ago I saw a patient who was sent to the Riviera for neurasthenia and general anemia, when at the first examination I found a carcinoma of the rectum. A most excellent rectal speculum is that of Otis, which was modified somewhat by my assistant, Dr. Küttner, so that it is introduced with considerable ease.

When the carcinoma in the sigmoid is slow in its development and grows to the outside, it is not difficult generally for diagnosis. The patient has in the beginning slight disturbances in his stools; there may be constipation alternating with watery or mucous discharges. Such discharges are characterized by the fact that astringents or opiates, either internally or by suppositories, do not affect them. The stools become tape-like; there may be discharge of bloody masses or pure blood may coat the stools, often combined with glossy mucus; however, the stool may look entirely normal in shape and color and, nevertheless, contain blood. It is of the utmost importance in such stools to see whether the blood is macroscopically within the feces by cutting through them, or this can be determined by chemical examination

I have sometimes seen stools which were well formed and brownishyellow in color, and without apparent abnormality, show with the Guajai test and other reactions undoubtedly large amounts of blood. When the growth degenerates, then the discharges contain a large amount of bloody material, with a foul odor. Simultaneously there develops a more or less painful cylindrical tumor in the left iliac fossa or distributed in nodular masses upward against the crest of the ilium. There is but slight tenderness or pain subjectively, and the general health is not markedly attacked.

When the growth is small and annular, the palpation may be fruitless when the abdomen is rigid and the patient is not yet emaciated.

Under such circumstances, after examination in a warm bath, in which the abdominal walls become relaxed, or after insufflation of the intestine, the diagnosis is made somewhat easier. When this is of no avail, and if in addition the general condition is not much changed, the whole complex seems to speak against a carcinoma of the colon. For the diagnosis, then, there remains nothing but the changes in the character of the stools or of the other functions of the bowel. One such case I saw in a patient in whom I diagnosed a carcinoma of the sigmoid flexure four years before his death, because of continuous irregularity of the stools and discharge of blood, without originating from any known focus. During one of my vacation trips the patient was examined by another well-known authority, who disputed my diagnosis because

of the good general condition of the patient. However, my opinion was confirmed by the autopsy. Most suspicious for such cases is the fact that there is a constant loss of weight for which there is no known cause; the appetite remains good; there is no vomiting and no local pain. In many such cases obstruction suddenly occurs, with all its characteristic symptoms. Often the physician believes he has an intestinal strangulation, volvulus, or intussusception to deal with, whereas on operation a tumor is seen to be the cause. Such an accident happened to the calchysted French clinician Potein to the celebrated French clinician, Potain.

to the celebrated French clinician, Potain.

Another group of cases are those in which the neoplasm grows into the lumen of the intestine, drawing the outer wall into it, causing no thickening and being hardly possible to palpate. Also such growths for a long time may lead to but slight symptoms or no symptoms at all. Suddenly there may occur an obstinate constipation lasting for several days, but relieved by laxatives and cathartics. Under such circumstances we have already a narrowing of the lumen, which becomes blocked by a fecal cork. Such attacks may repeatedly recur until finally cathartics, etc., are of no use. Distention of the abdomen may occur, but not necessarily confined to the descending colon. The general condition in these patients is but slightly affected in comparison to those cases of acute obstruction in strangulation, hernia, intussusception, etc., and the symptoms of ileus, such as fecal vomiting or fecal contents of the stomach occasionally emptied through the stomach-tube, are never present. In one of my cases, the continuous passage of gases pointed to an incomplete obstruction. Notwithstanding that no tumor could be palpated and that symptoms apparently began suddenly with an acute ileus two days before admission to the hospital, I diagnosed carcinoma of the sigmoid flexure because of the following: 1. During the past year there were four attacks of constipation with pains. 2. Moderate distention of the abdomen and more marked distention in Moderate distention of the abdomen and more marked distention in Moderate distention of the abdomen and more marked distention in the left iliac fossa. 3. Moderate pain in this region, both subjectively and objectively; the pain recurred on some days at regular intervals of ten to twenty minutes, lasting one to two minutes and radiated outward from the sigmoid. 4. Rectum negative. 5. Neither water nor air could be introduced in large quantities into the intestine by the rectum. 6. The general condition of this fifty-seven-year-old patient was but slightly changed; pulse 60, normal in quality; urine contained indican; stomach contained no fecal masses. 7. For two days, despite all means, no passage of stool, but occasional passage of gas. The operation showed a circular carcinoma, which occluded the whole lumen of the sigmoid and allowed but a corkscrew-like channel large enough to admit a knitting kneedle. to admit a knitting kneedle.

But all of these tumors, when they have symptoms, are comparatively easy to recognize. Much more difficult is the next group of cases

which I shall now speak of. Under normal conditions we are able sometimes to feel the cord-like descending colon or the sigmoid flexure, which may be tender to vigorous palpation, when the abdominal walls are thin and relaxed. The cord-like feel disappears when the colon is emptied or inflated. When there are no symptoms of any intestinal disease it is not difficult to diagnose the character of such a tumor-like resistance. It is entirely different when there is a spastic contraction of the colon simultaneous with other symptoms, such as obstipation, irregular movements, pain and disturbance of the general condition. Under such circumstances we are compelled more to think of a malignant growth. When the spasm disappears after a specific therapy, such as suppositories of belladonna and morphine or small injections of oil or of chamomile tea with a few drops of tincture of opium, the tumor also disappears. Such spasms may occur as a pure neurosis, either as a sequel to irritation of the celiac plexus or as a symptom of spinal-cord irritation, or in tabes or basilar meningitis. It may also occur in hysteria or as a reflex in inflammatory or ulcerative conditions of the neighboring organs and other parts of the intestinal tract. This latter can occur in inflammation or ulceration of the rectum, as in fistulæ, syphilitic ulcers, and ulcerating hemorrhoids. It may also occur in dysenteric and tuberculous processes. When the character of the stools and the general condition is similar to that in carcinoma, then there is a strong liability to mistaken diagnosis. To illustrate this I shall mention the following:

The patient, a man aged thirty years, who, up to eight days before admission into the hospital, gave in the history that he was always in fairly good condition. On examination, in the left iliac fossa was found a hard, cord-like tumor, which was believed to be a neoplasm of the sigmoid. The tumor mass was quite tender, whereas the ascending transverse and beginning descending colou were not at all tender to touch. Neither digital nor rectoscopic examination disclosed anything abnormal in the rectum. The somewhat reddened mucosa covered with mucus was without any defect. On inflating the colon, although only a small amount of air could be injected, the patient complained of severe pain and the tumor remained unaltered. During his first days in the hospital, under oil injections, the stools, were soft, brown, with but little mucus, blood, or pus. Evening temperatures were 103.6° to 103.8°. On the eighth day of his stay laparotomy was performed, and we found the colon thickened and somewhat hard, but no tumor was present. The serosa was smooth and glossy, and owing to the frequent muscular contraction the serosa was at regular intervals drawn inward, giving the colon the appearance of a screw. Adjacent to the colon were a number of slightly swollen glands. The nature of the process within the intestine could not be at this time determined. A new-growth of the intestinal wall was not possible to exclude; more likely it would be possible to think of a tubercular process or a dysentery, but least pointed to the latter. The operator

excluded the whole colon and made an anastomosis by means of a Murphy button between the excum and a very low part of the sigmoid. For two days after the operation the patient did very well and passed no blood in the stools, but on the third day he went into sudden collapse and died. Autopsy showed the operation to be perfectly successful and no peritonitis. The whole colon from the middle of the transverse portion to the flexure showed a dysenteric condition present, but most marked in the flexure

Even though the age of the patient spoke against carcinoma, the fact that such a distinct tumor could be palpated, the cachexia, the passage of very small amounts of mucus and blood, the glandular swellings, the absence of all symptoms of dysentery from the history, and his condition while in the hospital—all this was indicative enough to diagnose carcinoma.

It is also possible for a swelling of the colon to occur in the left iliac fossa with a tumor in another portion of the intestine. A distinct type of such a condition I was enabled recently to observe:

Man, aged sixty-nine years, who had the symptoms of a chronic ileus. In the lower left abdomen we could feel a cord-like tumor, hard but entirely painless, and apparently adherent in the lower part. In the knee-elbow position we were able to feel per rectum a number of small, pea-like nodules at the beginning of the sigmoid, lying apparently under the mucosa, and the intestinal wall at these points appeared thickened. The descending and transverse colon at times showed evidences of distention, at some times more marked than at other times. In the hepatic flexure was a hard swelling, and so movable that we thought of a movable kidney, but this swelling disappeared under massage. Subsequently the patient had fecal vomiting, and was operated on. To our surprise there was no tumor of the sigmoid flexure; in fact, this was entirely free and only a few slightly swollen retroperitoneal glands could be made out, which we felt through the rectum. However, an inoperable carcinoma of the hepatic flexure was found and a right-sided colostomy made. After this the distentions of the colon ceased and the patient felt so well that he left the hospital. Evidently the condition of the sigmoid was reflex to the presence of the neoplasm of the hepatic flexure.

Such experiences lead to caution in the consideration of such tumors. Not long ago I was seen by a patient who was practically prepared for operation. Another physician had diagnosed a carcinoma of the sigmoid and advised immediate operation. A tumor could readily be palpated in the left iliac fossa and the patient passed blood in his stools. On close examination, however, the stool was of good form and only covered in its outer surface with blood. The interior of the stool contained no blood. Under chloroform narcosis the tumor disappeared, and with the aid of the Kelly proctoscope I was able to detect one highly situated bleeding, hemorrhoid. This was cauterized at this time, and all bleeding ceased. The best evidence that the tumor was not due

to a neoplasm is that the patient within the last half-year gained more than eight pounds in weight. Some time ago I published a series of cases and showed that such hemorrhages from highly situated hemorrhoids could be the source of continuous bleedings and severe anamia, the real cause of which is not detected. When the blood is passed with the feces and is not visible, the true condition remains unrecognized and pernicious auæmia is thought of.

There are, of course, other tumors in this region, such as those originating from the uterus and appendages, from local peritonitis, intussusception, etc. These conditions I will not discuss because under careful examination they are easily recognized. I would much rather speak of autointestinal intoxication as a result of marked constipation of long standing. In 1896 Herter and Smith published a very complete investigation concerning excessive intestinal putrefaction, in which they proved that in cases of dyspeptic and neurotic individuals the presence of ethereal or aromatic sulphates in the urine were decidedly increased, so that the relation between the preformed sulphates and ethereal or aromatic sulphates was much altered. Under normal conditions the ratio between the two is 1 to 14, whereas in autointestinal intoxication the ratio may sink to 1 to 5, or even lower.

I will not speak of the more chronic cases as described by Herter and Smith or by McCaskey, but will mention a group of cases which are acute in onset, very severe in their appearance, and accompanied by a more or less diminished sensorium of the patient. There may occur a paralysis of the extremities, complete absence of patellar reflexes, involuntary micturition and defecation; the whole picture strongly resembles a severe central brain disease. It is to be differentiated from brain disease by the bilateral paralysis, from meningitis by the absence of rigidity of the neck and the absence of the pupillary symptoms, and from disease of the spinal cord by the occasional occurrence of coma. If we palpate the abdomen of such patients we can feel more or less distinctly several hard, fecal masses in different parts of the tract. Digital examination of the rectum reveals this to be widely dilated, owing to the presence of many solid, fecal masses, which are not affected by irrigation, but must be removed by the fingers or other mechanical means. At the same time succussion of the stomach is distinctly present and indicates an atony of the same. Of three cases I found in one a dilatation of the stomach, but no enlargement in the other two.

If, however, we use irrigations of lukewarm oil or of hot water, we can empty the rectum of thick, dark-brown, solid masses; and if at the same time we empty the stomach by lavage of any stagnating material,

¹ Observations on Excessive Intestinal Putrefaction. New York Medical Journal, 1895.

² Anæmias Secondary to Gastrointestinal Disease, with Report of Two Cases. Journal of the American Medical Association, March, 1902.

the whole picture becomes suddenly changed. Consciousness returns, the paralyses disappear, and in a few days there is a complete return to the normal condition.

There can be no question but that such attacks arise as a result of absorption of toxic agents produced by putrefaction in the intestinal tract. In two cases I determined the ratio between the preformed and aromatic sulphates and found the latter markedly increased. Whether there is any further change in the metabolism of the proteid molecules and the formation of diamin, or if there occur gaseous products such as sulphureted hydrogen, I will not dispute. I have continually endeavored to isolate from the stomach contents, urine, and feces these toxins, which I found formerly in one case of tetanus and dilatation of the stomach, but without result. They are either too small in quantity or are so changeable that with our present methods we are unable to detect them.

CONCERNING THE NATURE OF CERTAIN CASES OF CHRONIC POLYARTHRITIS.

By David L. Edsall, M.D., of philadelphia,

AND

RALPH S. LAVENSON, M.D., of philadelphia.

During the last few years a number of articles have been published by Poncet, or by others under his guidance, in which there has been strong insistence upon a belief of Poncet's that some cases of chronic rheumatism, arthritis deformans, and even conditions that may readily be mistaken for acute rheumatism, are at times a form of tuberculosis of the joints-a possibility that has previously been casually suggested, only to be denied. Several years ago, while unacquainted with the articles by Poncet and his pupils that had then been published, one of us (Edsall), with the same thought in mind, began some observations on the effect of tuberculin injections in cases of chronic rheumatism and arthritis It was hoped that the tuberculin injections would provide a means of choosing certain cases for more detailed study, and would, perhaps, through the production of a severe local reaction, offer a certain amount of direct evidence of the truth of the theory. The opportunity to carry on these observations in any considerable number of cases did not present itself until the fall of 1902, when we continued the investigation conjointly, chiefly at the Philadelphia Home for Incurables.

We have now used tuberculin in eighteen cases of chronic polyarthritis—in part, arthritis deformans; the remainder, so-called chronic rheuma-

tism. The various classifications of cases of chronic polyarthritis used by different authors are so unlike and in some ways so confusing that our method of grouping cases perhaps needs explanation; we have, for the sake of some definiteness, used the main distinctions formulated by Pribram. In all but one of these cases, circumstances have limited our study to the usual methods of clinical investigation plus the effects of the tuberculin injections: in one case we have been able to obtain other important data. We believe that our results are sufficient to suggest that tuberculosis may be the cause of the joint disease in several of the cases: and in one case that will be described in detail the evidence in favor of this view is strong. In connection with the work of Poncet and his pupils, our results provide indication of the importance of determining in a large number of cases the actual relation that tuberculosis may bear to chronic polyarthritis. A definite decision can. of course, be reached only by direct histological and bacteriological study of the joints of a series of cases, and satisfactory opportunities to carry on such studies in a convincing manner are not often found and have not been afforded us. The most important difficulty in this is, of course, the fact that the subjects of chronic polyarthritis usually live for many years after their joint disease has made its appearance; and commonly when post-mortem examinations are made, the joint disease has long been quiescent and the factors originating it have probably ceased to act. If these were bacteria they have probably died.

Tuberculous disease of the joints as usually recognized is so different from either chronic rheumatism or arthritis deformans that one must at first be impressed with the thought that these conditions are essentially different in nature. It is not necessary to describe in detail their different characteristics; the chief of these alone are very distinctive.

Tuberculosis, in the great majority of instances, is monarticular, or, at most, oligoarticular; and when it progresses unchecked for any considerable length of time it nearly always exhibits its characteristic tendency to fungous growths, gelatinous infiltration of the periarticular structures, abscess, and sinus formation. Both arthritis deformans and chronic rheumatism, on the contrary, tend strongly toward the involvement of many joints; they very often cripple practically all the joints to some degree; and neither of them is associated with changes in the joints or in the periarticular structures that are in any way similar to those seen in tuberculosis. Chronic rheumatism cripples its subjects through progressive fibrous, or sometimes ultimate bony ankylosis, while arthritis deformans accomplishes its results through the combined atrophic changes in the cartilages and the bones and the periarticular bony growths. In the rare instances in which actively destructive changes occur in the joints in these conditions, they usually

involve only one or two joints, and are commonly looked upon as accidental complications.

There are, however, certain relations between joint tuberculosis and chronic polyarthritis that are somewhat suggestive. Among these are the frequent occurrence of pulmonary tuberculosis in the subjects of chronic polyarthritis, the very common family history of tuberculosis and the fact that the same general conditions of environment that favor the development of tuberculosis are recognized as frequent elements in the early history of chronic polyarthritis. Such facts alone constitute but weak evidence of the correctness of our position, but they have some weight when we consider that there are rarer forms of joint disease that are known to be tuberculous and that exhibit characteristics midway between these two groups; and the usual dissimilarity between joint tuberculosis and chronic polyarthritis is less imposing if these two classes of cases are brought into analogy with chronic lymphatic tuberculosis in its two chief forms. We now know that many cases closely simulating true pseudoleukemia are really lymphatic tuberculosis; and the difference, both clinically and pathologically, between this condition and ordinary scrofulous glands is certainly quite as striking as that between ordinary tuberculosis of joints on the one hand, and the two chief varieties of chronic progressive polyarthritis on the other. Another somewhat analogous condition that is also worthy of mention, because it involves serous structures, is chronic multiple serositis.

This is, in a considerable proportion of cases, certainly tuberculous, though it often presents no distinctive clinical evidences of its nature, and it is often difficult to demonstrate at autopsy whether it is or is not tuberculous.

The points that have just been mentioned are those that led us to begin the observations that we are now recording. The reports of Poncet, Barjon, Berard and Destot, and Mailland have given us additional ground for active interest in the question. The facts of importance that have been brought forward by these authors are practically as follows: They have frequently observed the development of pulmonary or other clearly recognizable forms of tuberculosis in cases of chronic polyarthritis. In a number of cases they have noted the development of a condition that, clinically, was typical tuberculosis in one or two joints in subjects of so-called chronic rheumatism. In one instance the injection of fluid obtained by tapping such a joint produced tuberculosis in a guinea-pig; in several instances the injection of fluid or tissue from such joints, obtained post-mortem or through excision of the joint, produced tuberculosis in guinea-pigs. And, finally, Barjon and Berard and Destot, in a series of cases, secured skiagraphic pictures which they consider practically identical with those of tuberculosis of

the epiphyses, the pictures exhibiting the characteristic points of rarefaction in the ends of the bones.

Poncet and his students conclude from these results-somewhat hastily, we think—that they have established the fact that chronic polyarthritis is frequently of tuberculous nature. Their results scarcely justify so definite a decision. The skiagraphic pictures that they have published are suggestive, but not convincing; in fact, such a method of observation can hardly be entirely convincing. And the development of a condition that, clinically, seems to be tuberculosis of one or two joints, or even the bacteriological demonstration that one or two joints are tuberculous, does not constitute definite evidence that the disease in all the other joints is tuberculosis. It is, of course, possible for tubereulosis to develop in a small number of joints that are already the seat of chronic disease, purely as a complication of the original trouble, and such an occurrence does not demonstrate that the original polyarthritis was essentially tuberculous. Inoculations made from several joints that were not so evidently the seat of tuberculosis would, perhaps, have furnished convincing evidence of the correctness of Poncet's argument; but such a procedure does not seem to have been attempted, the inoculations apparently having been made solely from the joints that were clinically the sent of tuberculosis. The results of these observers are, however, extremely suggestive and deserve very serious attention.

Our own results in all but one of the cases reported are, at best, merely suggestive. In one special case we believe that the facts that we present constitute weighty circumstantial evidence. For the sake of brevity, we shall avoid almost all details in mentioning the individual cases, merely stating the general class to which each ease belongs and the important facts relating to it.

Of eighteen cases injected with tuberculin, eight gave absolutely no reaction, three gave a doubtful reaction, and seven gave a distinct

reaction. The main points about these cases are as follows:

Of the eight that did not react, all but two were typical arthritis deformans. Of the two exceptions, one (Case I.) was a chronic rheumatism of four years' duration in a man aged twenty-five years. There had been repeated mild exacerbations of the condition, and the disease had produced partial fibrous ankylosis of all the larger joints, except the hips, of the carpus and the tarsus, and of a number of the fingers. There was no evidence of bony change. The patient had no enlarged glands, and his temperature was constantly within the normal bounds. The other case not arthritis deformans (Case II.) was an obscure case of multiple hydrarthrosis of two years' duration in a man aged thirty-four years. This patient had no fever, no glandular enlargement, and there was no evidence of bony change. The condition was confined to the large joints.

Of the six eases of arthritis deformans that did not react, one (Case III.) occurred in a woman aged seventy-two years, was of three years' duration, had begun in the small joints, and had involved nearly all

the joints of her body. She occasionally had a rise of temperature up to 100° F., and the temperature varied irregularly between 97° F. and 100° F. She had bony grating in many joints and osteophytes about numerous joints. She had no noteworthy glandular enlargement, except one gland, the size of a hazelnut, in the left axilla. The second of these cases (Case IV.) was in a woman, aged seventy years, whose disease was of twenty years' duration. She had no irregularity of temperature and no glandular enlargement. The disease was characteristic. widespread arthritis deformans involving both small and large joints. Case V. was in a woman, aged seventy years, whose disease was of thirty years' standing and had produced typical advanced lesions of arthritis deformans. She had no irregularity of temperature and no glandular enlargement. Case VI. was similar to the last described; it was in a woman, aged seventy-two years, was of twenty-eight years' duration, and had produced advanced lesions. There was no irregularity of temperature or glandular enlargement. The seventh case was in a woman aged fifty-three. The disease had lasted twenty-seven years, had involved nearly all the joints, and had produced typical changes. Her temperature was always practically normal, and there were no glandular enlargements. The eighth case was in a woman aged fifty years. The disease was of twelve years' duration; it had produced extensive lesions and most remarkable atrophic changes in many of the joints, with very marked deformities. She had no glandular enlargement. She frequently had a rise of temperature to 100° F., or slightly higher; but this was probably due to an intractable bed-sore.

The three cases that gave a doubtful reaction were as follows: The first (Case IX.) was in a man, aged forty-two years, who had had chronic rheumatism with repeated febrile exacerbations for somewhat over two years. The disease had produced thickening about the tarsus on both sides. The ankles were partly ankylosed, and the knees, wrists, and one elbow were extensively diseased. The patient had no glandular enlargement. The injection of 3 mg. of tuberculin was followed by fever and severe joint pains; but, since this was immediately succeeded by a febrile course with renewed joint symptoms lasting for ten days, and since the temperature began to rise almost immediately after the injection, what was at first thought to be a reaction was probably merely an exacerbation of the disease. The patient soon disappeared from observation, and the injection could not be repeated.

The second case in which there was a doubtful reaction (Case X.) was in a man, aged sixty-six years, who had extensive chronic rheumatism, involving all the large joints except the hips and most of the small joints of the hands and feet, with effusion into some of the smaller joints. Three mg., 6 mg., and 10 mg., respectively, were given him at intervals of four days. His temperature varied irregularly from 97° F. to 99.2° F. ordinarily. The tuberculin caused no wider range of temperature; but after the injection of 6 mg. he complained of pain and soreness in all his joints, and after 10 mg. he had a general feeling of illness and intense pain in many joints. The joints presented no objective signs at these times. The man had a chronic cough, but had no tubercle bacilli in the sputum and no evidence of tuberculosis upon physical examination of the lungs, even directly after tuberculin had been administered. A number of axillary glands on both sides were

enlarged, some of them being at least three-quarters of an inch in diameter.

The third doubtful reaction (Case XI.) was in a man, aged thirtyone years, whose disease had lasted fifteen years and was of the type of
chronic rheumatism, involving almost all the large joints and the
majority of the small joints in the hands and feet. There was some
effusion in several small joints, but no evident bony change. The
patient's temperature had twice within a fortnight been recorded as
high as 100.2° F. Three mg. of tuberculin were administered on
December 7th, and forty-eight hours later his temperature reached
100.8° F. This had not been recorded, and 6 mg. were given the following morning, when the temperature was still somewhat elevated.
The injection of 6 mg. was followed within twelve hours by an elevation of temperature to 101.4° F., the temperature gradually falling to
normal within eight hours. There were no noteworthy subjective symptoms. This man showed marked enlargement of the axillary glands,
several being an inch or more in diameter. The inguinal glands were
quite large, and there were a few glands, the size of peas, palpable
in the neck. The patient showed no evidence of pulmonary tuberculosis.

Of the seven cases that gave a distinct reaction to tuberculin, four were characteristic arthritis deformans, two were typical chronic fibrous rheumatism, and one was an instance of Still's type of chronic polyarthritis of childhood. Two of the cases of arthritis deformans presented some signs of apical disease of the lungs. In one of these cases the signs were extremely slight; in the other they were fairly definite. The reaction in these two cases is probably of no consequence in relation to the nature of the joint disease, as it is likely that the pulmonary trouble caused it. These two latter cases were as follows:

The first (Case XII.) was in a woman, aged fifty-three years, whose disease was of seven years' duration, had involved nearly all the joints, and had produced most curious and interesting atrophic changes. The patient had ordinarily a perfectly normal range of temperature. She had a slight contraction of the extent of resonance above the left clavicle, with some impairment of resonance. There were no auscultatory signs. She had enlarged glands in both axillæ, a number being the size of large hazelnuts; and there were several glands in the neck the size of large peas. The injection of 3 mg. of tuberculin caused a rise in temperature to 100° F., with a slight feeling of malaise. Six mg. produced a similar rise in temperature, with a general feeling of intense malaise, nausea, vomiting, and headache. The patient also complained of some soreness in a few of the joints; but this was not marked, and was accompanied by no objective signs.

The other case with pulmonary signs (Case XIII.) was in a woman aged thirty-two years, was of nine years' duration, and had produced characteristic advanced lesions of arthritis deformans. The axillary glands were enlarged, a few being as much as an inch in diameter; numcrous cervical glands were readily palpable. Ordinarily she had no abnormal range of temperature. The injection of 3 mg. produced no result. Six mg. had no definite effect upon the temperature, but gave the woman a feeling of marked malaise and some general pain. Ten mg. caused a rise in temperature to 100° F., general intense malaise, nausea, and diffuse aching. She complained particularly of the pain

in several joints, which had previously been for a long time practically

free from pain.

Of the cases with no pulmonary signs that showed a distinct reaction, one (Case XIV.) was in a woman, aged sixty-three years, whose disease was of twenty-seven years' duration. There was characteristic advanced arthritis deformans. Numerous axillary glands were readily palpable. The patient ordinarily had no fever. The injection of 3 mg. was followed by a rise in temperature to 100.2° F., some general aching pains, and a feeling of malaise. Six mg. given nine days later produced a rise in temperature to 101.2° F., general intense malaise, headache, and aching pains. She had no special joint symptoms at this time, and there were no objective changes in the joints.

Case XV. was in a woman, aged thirty-three years, whose disease was of four years' duration. It was typical arthritis deformans that had very rapidly advanced and had produced changes in almost all the joints, including the jaw and the spinal column. She had no abnormal range of temperature, no signs of pulmonary disease, and no glandular enlargement. The injection of 1½ mg. of tuberculin produced a rise in temperature to 101° F., with general malaise, but with no localized

subjective or objective symptoms.

The sixteenth case was in a man, aged thirty-seven years, whose disease was of seven years' duration. It was chronic rheumatism that had involved most of the large joints and had produced irregular involvement of many small ones. His temperature range was ordinarily He had no glandular enlargement, and no signs of pulmonary His joints gave him no noteworthy active discomfort. Three mg. of tuberculin caused no rise in temperature; 6 mg. produced a rise to 100° F., with no general signs. Ten mg. caused a rise to 101.6° F., with a general intense feeling of illness, headache, nausea, and general aching pains. He had very marked pain in many joints, and a number of them became extremely painful and very tender upon palpation, these joint symptoms subsiding rapidly within twelve hours. He had no evidences of a reaction in the lungs.

The seventeenth case was in a woman, aged forty-four years, who had chronic rheumatism that had lasted for two and one-half years, and had involved the tarsus and carpus on both sides, both ankles, knees, and wrists, and the left elbow. She had no abnormal range of temperature, but had slight glandular enlargement in the axillæ and groin. The injection of 1½ mg. of tuberculin caused her temperature to rise to 101° F. There was also severe pain in the wrists and knees (the joints most recently involved), with a good deal of tenderness and of pain on moving these joints. This patient, however, was subject to frequent exacerbations of her joint symptoms.

The eighteenth case is the one upon which we would lay especial stress, and it will be mentioned in somewhat greater detail than the others. It was an instance of Still's type of chronic polyarthritis associated with marked glandular and splenic enlargement. The patient was a boy who before his admission to the Home for Incurables had been in the Children's Hospital under the care of Dr. Stengel and Dr. F. A. Packard. We have kindly been allowed to make notes from the

records of the Children's Hospital:

When admitted to that institution in August, 1900, the boy was eleven years of age. He was ill-nourished, had been in very bad hygienic surroundings, and had been ill-treated by his parents. He had no tubercular or rheumatic family history. He had had measles at the age of eight years, but no other illness up to the time that his joint trouble began, in March, 1900. The right ankle was first affected; then the right foot; next the left ankle and left foot. In June, 1900, the right knee had become involved; then the left; and in July both hands. There had been no severe acute symptoms; but the child's general health had gradually failed with the progress of the joint disease, and the joints involved had grown progressively worse.

When admitted to the Children's Hospital the patient's axillary glands were noted to be swollen and hard. The posterior cervical glands were not enlarged, but the epitrochlear and ingninal glands were palpable. The splenic dulness was increased. The main facts concerning the joints at that time are that the wrists were swollen and there was fluctuation over them; the finger-joints, especially the first and second phalangeal, were swollen and hard; the metatarsophalangeal joints of both great toes were swollen and tender; the ankles and the region over the tarsus were also swollen and somewhat tender; and the knees were enlarged, movement at the knee-joint causing pain. The blood examination showed 6,000,000 red cells, 14,000 leukocytes, and 60 per cent. of hæmoglobin. There was a systolic murmur over the pulmonary region of the heart. That organ was otherwise normal, except for a moderate accentuation of the second pulmonary sound.

The child remained under observation in the Children's Hospital until March 13, 1901, when he was sent to the Home for Incurables. During his stay in the Children's Hospital there had been repeated temporary exacerbations of the objective and subjective signs in the various joints, and it was repeatedly noted that increased glandular enlargement had occurred in regions corresponding with the joints that had shown active signs. The leukocytes were several times counted: after the first count they were found to be near 8000. The temperature was very irregular, mounting to 100° F., and frequently higher, sometimes up to 102.3° F., every day until September 4th. It was then nearly normal until October 2d. After this it ranged as high as 102° F., frequently for a week, and then remained nearly normal for two weeks. It was then elevated daily for a month to as high as 102° F. Similar variations in temperature were exhibited up to the time of the patient's discharge. It was noted that gentle massage of the joints was painful and seemed to increase the symptoms. He was discharged unimproved.

The notes upon his admission to the Home for Incurables were much the same as those that have been mentioned. When first seen by us, in July, 1902, he had improved in general nutrition. His joints remained much as they had been upon admission, though he had for some months had no pain in them, and no increase in other joint

symptoms.

He had at that time very striking glandular enlargement. The anterior and posterior cervical glands were palpable in great number and were of various sizes, ranging up to the dimensions of a pigeon's egg. The axillary glands on both sides were very large, there being a number in the right axilla that were as much as an inch in diameter. In the left axilla there was one as large as a small hen's egg, and several with a diameter of about an inch. The brachial glands were

very readily palpated. A number of the inguinal glands were as large as a hazelnut. The splenic dulness was distinctly increased, but the spleen could not be felt. This was perhaps due to the fact that the boy's deformity rendered it likewise difficult to palpate the splenic region.

He had no definite signs of pericarditis, a frequent complication of this type of joint disease. He had likewise no other signs of cardiac disease, and no signs of disease of the lung; the abdominal signs were

also normal. The joint conditions were as follows:

The jaw was unaffected. The head could be rotated but little, and was held bowed forward somewhat; there was but little anteroposterior motion. The lower cervical spine could not be felt to move. shoulder was practically free. In the right shoulder anteroposterior motion was moderately limited, and the arm could be abducted only There was no appreciable enlargement about the about 30 degrees. At the left elbow the arm could be extended only a little beyond a right angle; it could be further flexed fairly well. The movements of the radius were fairly good. There was no enlargement of the joint. The right elbow was globose in appearance; it was held at about 100 degrees, and was almost absolutely fixed. There were no bony enlargements, but the whole joint was somewhat rounded from thickening of the soft tissues. Both wrists were held almost rigid at about a right angle. There was very slight motion in either. There was no noteworthy thickening about the wrist-joints themselves; but on each side there was marked swelling of the carpus and of the upper half of the metacarpus, particularly on the right. There was apparently some fluid on the right over the carpus, the swelling otherwise being due to thickening of the soft tissues; no honc enlargement was demonstra-The carpal and metacarpal joints were rigid. The metacarpophalangeal joints on both sides showed very little motion, flexion beyond a straight line being practically impossible. The joints were The joints were held overextended, and were capable only of slightly greater extension. At the first and second metacarpal joints on each side there was marked thickening, which seemed to be partly of the ends of the bones. On both sides the first interphalangeal joints of all the fingers were thick-ened, this being especially marked in the left hand. The epiphyses of all the fingers of the left hand, and of the first two of the right hand were apparently thickened at this joint, and there was also thick-ening of the soft tissues. The middle, ring, and little fingers were flexed at about a right angle, and there was practically no motion in the interphalangeal joints. The first finger on each side showed a little more motion. The thumbs on each side showed thickening and apparently subluxation at the metacarpophalangeal joint. Both joints were almost entirely fixed, the last joint showing also some enlargement; this appeared to be in part of the bone.

Motion in the left hip was slightly limited; the right hip was practically free. The knees were globose in appearance. The ends of the bones felt somewhat enlarged, and there was thickening of the soft parts, with partial obliteration of the normal prominences. There was some fluid under the left patellar tendon. At the knees the legs were held at a right angle; they could be bent back somewhat farther on the thigh; they could be straightened only very little. The ankles showed decided limitation of motion. The ankle-joints looked somewhat globose, and the appearance of swelling extended over the tarsus and

metatarsus. There was no fluid in this region, but there was thickeuing of the soft parts, particularly over the tarsus. The tarsus and metatarsus were rigid. There was practically no involvement of the toe-joints. There was no definite bony grating in any joint.

The following is a skiagraphic report of Dr. H. K. Pancoast, who was kind enough to make a series of plates for us on May 4, 1903. Only the main points in connection with those joints that showed note-

worthy lesions are mentioned.

Left Hand and Wrist. Dense adhesions are present between all the carpal bones and in the radiocarpal articulation. The same is true along the line of the carpometacarpal articulations, especially between the first and the second metacarpals, and between the trapezium and the trapezoid. There is apparently a slight subluxation at the ulnar side of the first phalanx of the thumb. There are well-marked adhesions in the latter joint as well as in the interphalangeal joint. Deposits are present in the other metacarpophalangeal joints, with a widening of the proximal epiphyses of the phalanges.

Right Hand and Wrist. The radiocarpal, carpal, and carpometacarpal joints present a similar appearance to those of the right hand; but the adhesions are denser. The proximal ends of the first phalanges show a decided widening, corresponding with the epiphyses. There is a loss of bony substance in the distal end of the second metacarpal. The same end of the third metacarpal is apparently worn away on the radial side where the proximal end of the phalanx is overdeveloped.

Right Elbow, Lateral View. The olecranon epiphysis is possibly more advanced in ossification than is usual at this child's age. There are dense adhesions between the posterior portion of the olecranon and the region of the olecranon fossa. The elbow is flexed at about 120 degrees. There is no loss of bony substance at this articulation. There are a few adhesions between the coronoid and the anterior surface of the humerus on this side.

Left Knee, Lateral View. There are well-developed adhesions between the patella and the lower femoral epiphysis, the patella being in relation with the latter only. The adhesions apparently involve both condyles. The remainder of the joint cavity is fairly clear. There seems to be a thickening of the articular surface of the upper tibial epiphysis. There is no apparent loss of bony substance.

Right Knee, Lateral View. There are well-marked adhesions between the patella and the femur and between the femur and the tibia; and the articular surfaces of the femur and the tibia show very marked thickening, this being much more pronounced than in the other knee. There is a decided increase in calcification at the epiphyseal line in

the upper end of the tibia, as compared with the opposite side.

The Hips. Both hips show marked adhesions between the femoral head and the acetabulum, and marked thickening of the articular surface of the femur. The angles of the necks seem to be more obtuse than is normal. The necks are greatly thickened, and on the left side

the infiltration may readily be seen to involve the capsule.

Since the time of the physical examination described above, the boy has shown gradual but very distinct improvement. He has put on flesh; his color is good; and many of the joints have decidedly improved, so that while he was confined to a roller-chair in July, 1902, he is now able to run about with rapidity on crutches and to walk about a little

without either crutches or cane. His knees and ankles, particularly, are much improved in motion; and the wrist-joints and some of the joints of the fingers show decided improvement. Except for the result of the tuberculin injections, he has had practically no pain in any of his joints during the last year, though he has occasionally felt stiff. The glandular enlargement has decreased to a very striking extent. There are two or three glands in the neck that are still as large as peas, but none larger; and except for these the cervical glands are now scarcely palpable. The glands in the right axilla have become moderately reduced in size. Those in the left axilla have greatly decreased in size, so that at the time they were extirpated at an operation to be mentioned the largest was about an inch and a quarter in diameter. The inguinal glands are distinctly smaller than they were.

During the early part of the year the boy still had some tendency to rises of temperature. The temperature was usually nearly normal, but would occasionally shoot up to 100° F., and rarely to 101° F. These rises of temperature were not accompanied by any other symptoms. The results of the tuberculin injections in this boy were as follows: On October 29th 1½ mg. were injected without any definite result. On November 5th, at 3 p.m., 3 mg. were given. On the 6th, at 3 a.m., the temperature was 101° F.; at 6 a.m., 102° F. It persisted at about the latter point for six hours and then gradually

declined, reaching normal at midnight. The boy felt generally miser-

able. His joints, which had been free from pain for months, became quite painful, and he begged that his daily massage be omitted, as he felt that he could not stand it because of the tenderness of his joints and the pain on movement.

Because the patient had, under ordinary circumstances, a tendency to fever, another injection was given, on November 12th, at 9 A.M., the temperature meanwhile having been regularly below 100° F. At 3 P.M. the temperature was 100.4° F., at 6 P.M. 103° F. It remained at near 102° F. for twenty-four hours, and then rapidly declined to normal, remaining nearly normal for four days after this, when the regular temperature records ceased. With this last reaction the boy was nauseated, felt quite ill, and complained bitterly of intense pain and tenderness in a number of joints. The wrist and ankles were swollen, there was some redness over them, and movement of the joints caused intense pain. The glands were slightly tender, but there was no change in their size or consistency. The patient had no pulmonary signs during the reaction, and none could be discovered at any other time. Since this time the boy has had no active joint symptoms, and there has been a progressive tendency toward improvement under the use of very gentle massage and general treatment.

On March 28, 1903, Dr. Jopson removed the glands from the left axilla, securing eighteen of different sizes. They were strongly adherent to each other, to the sheath of the vessels, and to the surrounding connective tissue. The largest was somewhat over an inch in diameter; there were two about three-quarters of an inch in diameter; the others Their macroscopic appearance was in no way were much smaller. There was not the slightest gross appearance of tuberculosis, and the glands were of about the normal color and consistency. Dr. Ravenel kindly made sections and animal inoculations from these Microscopic examination showed absolutely no histological

evidence of tuberculosis, the only noteworthy changes being enlargement of the Malpighian bodies, the cells in which stained rather poorly; these changes were not striking. Several sections were examined for tubercle bacilli, but none were found.

The inoculations were made from an emulsion of several of the largest glands, this emulsion being of a consistency just sufficient to allow of its passing through a hypodermic needle. Five c.c. of it were injected into each of two guinea-pigs. The emulsion was stained with carbol-fuchsin, and a large number of acid-fast organisms with a perfectly typical appearance of tubercle bacilli were readily discovered, some of them lying singly or in twos, others forming quite numerous, fairly large clumps.

To our surprise, the result of the inoculation of the guinea-pigs was entirely negative. The animals remained well for five weeks thereafter, when they were killed. Dr. Gilliland, in the absence of Dr. Ravenel, kindly examined them. Most careful search showed

absolutely no evidence of tuberculosis or other disease.

The fact that the acid-fast bacilli in the glands were tubercle bacilli cannot well be doubted, particularly in view of the response to tuberculin. The result of the inoculations shows that they must have been either dead or of extremely low virulence. Dr. Ravenel believes that they were dead, for they were present in large numbers, and a great many must have been injected into each guinea-pig in the 5 c.c. of emulsion. It is, of course, possible that some of them were dead and that some were of low virulence and still living. Naturally, this point cannot be definitely settled.

Conclusions. The observations just noted indicate that the boy whose case has just been discussed has tuberculosis. We believe also that the intense local symptoms in the joints after the tuberculin injections; the fact that the glandular enlargement has been so distributed as to be in apparent relation with the joint disease; that much of the glandular enlargement is known to have occurred after the onset of the joint disease; and, finally, the fact that the glands have several times been noted to be enlarged or decreased in size in accordance with the progress of the joint disease, all indicate that the joint disease stood in close causative relation with the glandular enlargement, and that both were produced by the same factors. If the joint disease is tuberculous it would seem that it must be of an even lower degree of virulence than ordinary joint or bone tuberculosis.

As to the more general conclusions to be drawn from our observations, we consider, in the first place, that this last case indicates that it is probable that a certain proportion at least, perhaps a large proportion, of the cases of chronic polyarthritis of the type described by Still constitute a peculiar form of tuberculosis of the joints. This seemed to us a very definite possibility, even before we observed the facts presented concerning this case, for children with this form of polyarthritis usually exhibit irregular fever and have striking general glandular enlargement—conditions that, without any disease of the joints, would provide

the main characteristics of chronic lymphatic tuberculosis of the Sternberg type. It does not seem wholly probable that all cases of this type are tuberculous, but this is a point that cannot wisely be discussed without further observations.

As to the other cases recorded, the effect of tuberculin can be considered to be of decided interest in but three instances, in the sixteenth and seventeenth cases and in the tenth case. The latter has been mentioned as giving a doubtful reaction, but it was doubtful only in the fact that the patient had no fever. He had such marked pain and tenderness, and such distress on moving his joints after 6 mg. and 10 mg. of tuberculin had been injected, that the probability that this was a local reaction without a general reaction is strongly suggested. sixteenth case presented a striking set of joint symptoms at the time of the reaction, without any other marked general symptoms. joints became both painful and decidedly tender, while the man had for a long time previously had but slight symptoms in his joints even with other acute illnesses. In the seventeenth case the severe joint symptoms produced by the reaction were of somewhat doubtful consequence, because the woman had been so subject to exacerbations of her joint pains. The symptoms were, however, extremely marked and very suggestive. The reactions obtained in the other cases must for the present be considered as probably of little importance, either because of the probable existence of pulmonary tuberculosis, or because of the absence of accompanying joint symptoms.

We are aware that joint pains sometimes accompany a tuberculin reaction even when disease of the joints is absent. We also admit that in persons who are already the subjects of joint disease, joint symptoms are more likely to be produced by any temporary disturbance of health than in those whose joints are free from disease. likewise grant that a tuberculin reaction is not an infallible indication of the existence of tuberculosis; that it, at best, indicates only that tuberculosis exists somewhere in the body of the patient reacting, and does not usually demonstrate anything concerning any particular tissues; and it is extremely easy to overlook clinically some focus of tuberculosis in the lungs or in some other common seat of the disease. Hence, the mere development of a tuberculin reaction in a chronic joint case cannot, of itself, be considered to mean much, even though there are fairly striking joint symptoms at the time of the reaction; and we have no desire to draw any definite conclusions from these reactions. At the same time, we believe that the observations made in our eighteenth case render it quite possible that the reactions in those other cases which have been especially mentioned were due to tuberculosis of the joints. It is somewhat interesting that all but one of the cases reacting showed a noteworthy degree of glandular enlargement. and in none of the cases upon which stress has been laid could any evidence be found of the existence of tuberculosis of the lungs or of any tissues other than the joints or glands. The presence of chronic glandular enlargement of considerable extent and without other demonstrable cause is, in the present state of our knowledge, itself strongly suggestive of the possible presence of tuberculosis. It is, of course, possible that these patients reacted because they had tuberculosis of the glands and not of the joints; the facts that we possess do not permit of a decision on this point. We may, however, properly direct attention to the fact that all cases that we have mentioned with some emphasis showed severe joint symptoms at the time of the reaction, while none of them showed more than very slight tenderness of the glands. A recognizable local reaction in tuberculous tissues is common enough to make this point suggest that, in case both the joints and glands were tuberculous, the joints were the seat of a more active process.

In case tuberculosis proves to be a factor of importance in the etiology of chronic polyarthritis, it seems probable that cases due to this cause will be found chiefly in the group commonly classed crudely under the term chronic rheumatism. All our own most suggestive cases were of this class. It does not seem proper, however, to dismiss the possibility that arthritis deformans may be due to tuberculosis quite as brusquely as does Pribram, who admits the possible truth of Poncet's argument regarding chronic rheumatism, but disposes of it with a word when discussing arthritis deformans. Pribram's chief argument is that the radiographic pictures of tuberculosis are absent in arthritis deformans. We have previously stated that we do not believe that this method can offer final evidence of the presence of tuberculosis: we are equally convinced that it cannot positively demonstrate the absence of that disease. We know, for instance, that the microscope cannot conclusively settle this question with lymphatic tissue; hence it is improbable that the X-rays can do so with bone. Some of the more active cases of arthritis deformans that show febrile exacerbations and marked depression of the general health may, quite as properly as cases of chronic rheumatism, be studied from this standpoint. Should a considerable number of cases of chronic polyarthritis of any variety be shown to be tuberculosis of the joints of a peculiar form, it would be an important step toward clearing up our present uncertain knowledge of these conditions.

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CLINICAL LECTURE ON THE SYMPTOMATOLOGY AND TREAT-MENT OF TRIFACIAL NEURALGIA.¹

BY CHARLES H. FRAZIER, M.D.,
PROFESSOR OF CLINICAL SURGERY, UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE
UNIVERSITY HOSPITAL.

I WANT to call your attention to-day to some of the salient features of trifacial neuralgia, or tic douloureux—painful spasm—dwelling especially upon the clinical history and upon the indications for and the methods of treatment, prefacing my remarks with a brief reference to the etiology and pathology of the affection.

ETIOLOGY. It must be assumed that in every case the fundamental cause lies in some structural change, either central—that is, in the Gasserian ganglion; or peripheral, in one of its divisions. In a small percentage of cases we are able to single out certain conditions between which and the lesion itself the relation of cause and effect is easily Thus, for example, there are sources of peripheral irritation, in many cases infectious, such as herpes, or some lesion of the teeth and gums, which give rise primarily to a peripheral neuritis, and secondarily to neuralgia. On the other hand, and in by far the large majority of cases, we are bound to admit that the essential cause is either hypothetical or absolutely unknown; but there are certain systemic conditions which, by virtue of the fact that they are sometimes the forcrunner of this disease, have been regarded as "predisposing" causes. In this class we may include exhaustion hemorrhage, overwork, and strain; some forms of neurosis, as migraine, diabetes, chronic nephritis, gout, rheumatism, and lead poisoning. We know that women are attacked about twice as often as men, and the great majority of cases occur after the period of middle life.

Pathology. Not a great deal is known of this phase of the subject because, as yet, few opportunities have been offered the neuropathologist to make careful histological studies of specimens from individuals so affected; but from our present knowledge it can be positively asserted that there are two or three separate and distinct types of tic douloureux—one in which the lesion is primarily a neuritis of the peripheral branches, which subsequently may or may not extend to and invade the ganglion; the other, in which the primary lesion first appears in the ganglion is and a third, perhaps, in which the lesion is neither in the ganglion nor in its branches, but in the central nervous system. The lesion may be of a degenerative type, an interstitial neuritis or a neoplasm. Were the clinician able to recognize in his cases symptoms

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which would justify a classification corresponding to that of the neuropathologist, the indications for treatment would be more clearly defined. If the lesion was a peripheral neuritis, resection of the nerve trunk would be clearly indicated—a central operation would be unjustifiable; if, on the other hand, the lesion were primarily centrally situated in either ganglion or sensory root, the futility of the peripheral operation would be apparent.

Symptomatology. It would not be amiss here to remind you of a few facts concerning the anatomy and physiology of the fifth cranial nerve, or, as it is sometimes called, the trigeminus. It arises by two roots, a motor and sensory, the latter very much the larger. apex of the petrous portion of the temporal bone the fibres of the sensory root form a semilunar ganglion, the Gasserian ganglion. From the anterior border of this structure are given off three branches—the ophthalmic, the superior maxillary, and inferior maxillary; the first two divisions are pure sensory roots, but the third receives fibres also from the motor root. The motor root supplies the muscles of mastication, and the sensory root the skin of the face, the mucous membrane of the mouth and nasal cavity, the conjunctiva and cornea, and anterior part of the tongue with gustatory fibres. When the first division is involved the "tender points" will be found at the supraorbital notch, in the outer part of the upper eyelid, and at the emergence of the nasal branch at the lower edge of the nasal bone; the pain radiates over the anterior half of the head, to the evelid and eye itself, and to half of the nose; the second division gives off a few branches as it traverses the sphenomaxillary fossa and appears at the infraorbital foramen as the infraorbital nerve, where it divides into the palpebral, nasal, and labial branches. When this division is involved the "tender points" will be found at the infraorbital foramen, at the side of the nose, and over the most prominent portions of the malar bone. If the dental branches are involved pain will be referred also to the teeth and gums of the upper jaw. Finally, if the third division is involved pain will be referred to the distribution of one or all of its sensory branches; to the parietal eminence, temple, and external ear (temporal and auricular temporal branch), to the tongue (lingual), to the gum and teeth of the lower jaw (inferior dental branch), and to the lower lip (mental branch). The tender points are at the inferior dental foramen, where the auriculotemporal crosses the zygoma, over the parietal eminence, in the tongue, and at the mental foramen. This colored diagram, to which I direct your attention, differentiates from one another the cutaneous distribution of each of the three divisions.

Now, the particular group of symptoms exhibited by any individual case will depend upon whether the ganglion or one or all of its divisions are affected. In the vast majority of cases tic douloureux is a

disease of the second or third divisions. It often affects either one of these divisions alone, for a long period of time, although eventually it may extend to the other, but it is extremely rare for it either to begin or to remain localized in the first division. One of the patients, which I will show you to-day, suffered from this exceptional form of the disease. When he first came under my observation he was sixty-eight years of age; he had been a hard worker ever since he was ten years of age. He was not given to excesses of any kind. He himself had inherited no tendency to neuralgia, but one son and one daughter were subject to attacks of infraorbital neuralgia. About five years ago he first began to have sharp, shooting pains, referred to the course and distribution of the right supraorbital nerve. During the past four years on four different occasions the supraorbital nerve was divided, and in one instance a considerable section was resected, but after each operation the pain returned. After the first operation he enjoyed relief for about a year, but after each succeeding operation the period of relief was always shorter. I recite the history of the case chiefly because it illustrates this unusual type of tic douloureux in which the pain not only begins but remains localized in the first division. But the history of But the history of this case illustrates two other points equally instructive, but more commonly observed in this class of cases—I refer to the necessity for repeated peripheral operation, and to the gradual diminution of the period of relief after each successive operation. By far the great majority of patients that come under our care have already had a number of peripheral operations; they have become discouraged by the necessity for frequent recourse to operation, or, because the last operation afforded little or no relief, and plead for some more radical operation, no matter how desperate it may be.

Probably in the majority of cases of true tic douloureux you will be told by the patient that the pain began and was for a time restricted to the third division, and especially to its inferior dental branch, but that subsequently the remaining branches of the third division and the second division became affected. Last November Dr. Mills referred a patient to me whose history was more or less typical of this variety. The patient first complained of pain in the lower jaw, referred to the gums and teeth; believing the pain to be due to some disturbance at the roots of the teeth, the careless dentist recommended extraction, and one by one all the teeth of the right side of the lower jaw were extracted, but, as you would expect, without any relief. In the course of time the pain became more widespread and was referred to the mental and other branches of the third division. In the ward there is a patient upon whom I operated only a few days ago, whose history is very similar.

whom I operated only a few days ago, whose history is very similar.

I have told you a good deal about the seat and distribution of the pain, but what of its character and intensity? In the first place, as in the

neuralgias of other nerves, the pain is spontaneous and paroxysmal. The paroxysms may be brought on by draught or exposure, by fatigue, emotion, and movement; for example, opening the mouth. During the paroxysm the pain is sharp, stabbing, or darting, and occurs every few minutes; a series of these successive pains constitute a paroxysm, and several paroxysms an attack. As to its intensity the pain of trifacial neuralgia is in some cases the most agonizing of all with which man is ever inflicted. Victims of the severe type of tic douloureux are the objects of greater commiseration than any other class of patients. Sometimes they become so crazed with suffering as deliberately to take their lives. There is the widest variation in the frequency with which attacks recur; there may be an interval of only a few hours or several months. Usually as time goes on the attacks increase both in frequency and severity. There can be said to be no periodicity, except in those cases in which the neuralgia is of malarial origin, or in those cases in which the attacks occur only during the catamenial periods.

During the intervals the characteristic pains of the paroxysms cease, but the patient is not altogether free from suffering. He may complain of a dull pain in the distribution of the affected nerve, and pain may almost always be elicited by pressure over the so-called "tender points."

Associated with these sensory disturbances there may be certain motor, vasomotor, and trophic phenomena; we see sometimes convulsive movements of the muscles of the face (motor disturbances), lacrymation, salivation, flushing, sweating (vasomotor disturbances), certain erythemata, loss of hair, and loss of hair pigment (trophic disturbances).

CLASSIFICATION. It will be of great assistance to one considering the question of treatment to have clearly set forth in his mind a suitable classification of the various types of the trifacial neuralgia. have already alluded to three classifications: (1) a classification based on the seat of the lesion, ganglionic or peripheral; (2) a classification based upon the distribution of pain, whether in the distribution of the first, or the second, or the third divisions alone, or in two or all three of these divisions; (3) a classification, as suggested by Dana, which recognizes two types-one, the migrainous type, occurring almost always in women in early life, suffering from migraine; after a number of years it becomes chronic and becomes more localized, settling in the second or third or all three divisions. Dana considers this type to be an evolution of a definite trigeminal neuralgia on the basis of a migrainous neurosis. In the beginning it is a disorder of the sensory neuron, neither in the ganglion or its branches, but later certain degenerative changes may develop in the peripheral branches. The second type, and the more common of the two, affecting man as well as woman, occurs after the age of forty years, and is due to a definite lesion either in the ganglion itself or in its branches.

TREATMENT. With this brief summary of the symptomatology we may proceed to the subject proper of the hour, namely, the treatment. First of all, what resources have we upon which to draw or what courses have we to pursue? Generally speaking, they may be summed up under two headings: the medicinal or non-operative, and the operative. The question is naturally propounded—when is the one admissible, the other inadmissible, justifiable or unjustifiable, indicated or contraindicated? In answering this question the following factors must be weighed and considered: (1) the duration of the disease; (2) the frequency and severity of the attacks; (3) the causes of the attacks: (a) whether known or unknown; (b) whether removable or not.

It may be asserted that, at the onset at least, the treatment of all cases of trigeminal neuralgia belongs to the domain of medicine rather than surgery—according to Dana the migrainous type should never be subjected to operation, because the lesion lies not in the peripheral branches or in the ganglion, but in the central nervous system. Upon what grounds, you may ask, do we base our assertion that in its incipiency at least the treatment of trifacial neuralgia should be medicinal or non-operative rather than operative? Because clinical experience teaches us that by these means in a certain percentage of cases the disease may be arrested, if not permanently, at least for long intervals; furthermore, that in some cases the disease has a tendency to run its course, usually reaching its height in five or six-years, and then exhibiting a tendency to spontaneous cure. Probably in 20 per cent. of cases the disease is amenable to treatment other than operative. In what does the non-operative treatment consist? First, in the removal of all predisposing causes, such as malaria, anæmia, exhaustion, or any peripheral irritation, such as a carious tooth or antral disease; secondly, in the administration of drugs, and the drug which is par excellence the most efficacious, especially so in the exhausted and anæmic, is strychnine. In cases of but one or two years' standing, strychnine properly administered will arrest or control the disease almost invariably; but in order to obtain this result the drug must be administered in heroic doses, and the patient must be kept under the closest observation, and should be confined to bed. The remedy is administered hypodermically once daily, in gradually ascending doses, until, at the expiration of two weeks, the physiological limit is reached. Thus, beginning with one-thirtieth grain daily, the dose may be increased to one-tenth or one-eighth or higher, and when the maximum dose is reached it should not be given oftener than once on alternate days. After the pain has entirely disappeared the drug should be gradually withdrawn. As adjuvants to this treatment rest is regarded as of the utmost importance, and iodide of potash and the tincture of the chloride of iron as more or less helpful. One of the patients which you have seen to-day had enjoyed relief, only

temporary, however, from this mode of treatment. The symptoms recurred and a radical operation was performed.

Depending, as I have said, upon the duration of the disease and the severity and frequency of the attacks, it is perfectly proper and justifiable, for a period not exceeding a year at the utmost, to give medicinal measures a fair trial. If, however, at the expiration of this time or sooner, if the attacks are very frequent and severe and uncontrollable, every means of combating the attack have proven partially or altogether futile, it is your duty to recommend to your patient operative intervention as the only hope of relief.

This carries us up to the consideration of the operative treatment of trifacial neuralgia, and before discussing the respective operations let me tell you that all operative procedures for the relief of tic doulon-reux may be divided into two classes, according to whether the sent of operation is extracranial, i. e., peripheral, or intracranial, i. e., central.

What are the indications for each of these classes? If the physician was but able to distinguish between those cases in which the lesion was in the ganglion and those which were not, this perplexity would not exist; the indication for the peripheral or intracranial operation would be clearly defined; but, unfortunately, no means as yet have been suggested by which such a differential diagnosis may be established. Other considerations, therefore, must guide us in the selection of one or the other of these operative procedures, and chief among these is the number of branches involved. We ask the question—Is the pain confined (1) to one branch of one division, as the infraorbital branch of the second division, or the inferior dental branch of the third division; or (2) is the pain referred to all the branches of one of the three divisions; or (3) is the pain referred to the distribution of more than one division (if two it is usually the second and third divisions), or to all three divisions of the trigeminus?

The operations which may be required to meet one or the other of these indications are neurectomy (the so-called peripheral or extracranial operation), division of the second and third divisions at their entrance to the foramina and interposition of rubber tissue, extirpation of the ganglion and division of the sensory root (the so-called central or intracranial operations).

If, as so often happens in the early history of these cases, the pain is restricted to either the distribution of the inferior dental or the infraorbital branch, there is no question but that a peripheral or extracranial operation is the operation of choice, and for the following reasons: first, because in a certain percentage of cases it will be followed by absolute recovery; second, because in a still larger percentage it will be followed at least by a remission for varying periods of time; and third, because it is unattended with the risks that accompany the intracranial operation. In order to ensure the best results these operations should consist in a resection not of a small section, but of such an extensive section of the nerve as would make regeneration highly improbable. In the case of the inferior dental all that portion of the nerve between the inferior dental foramen and the mental foramen should be resected. In the case of the infraorbital nerve, that portion between the foramen rotundum and the infraorbital foramen should be resected. When a peripheral operation has not been carried out as thoroughly as it should have been, the pain will recur almost invariably, because the defect in the nerve has been repaired. In exceptional cases, even when a very extensive resection has been performed, as, for example, when the inferior dental nerve has been removed intact in its entirety from the dental to the mental foramen, that whole section of the nerve has been regenerated.

In order to guard against this the orifices of the dental canal should be plugged with some substance which the nerve fibres cannot penetrate. I have used silver foil in several cases, and up to this time with satisfactory results.

When recurrence follows one or more peripheral operations, or when the distribution of the pain becomes more widespread and is no longer limited to one but is referred to two or all the branches of the trigeminus, the period in which the peripheral operation is indicated has passed. There remains to be considered one or the other of the intracranial or central operations, and, of these, the two which are deserving of the most consideration are the division of the sensory root and the division of the second and third divisions at their entrance to their respective foramina.

The technique of operations upon the Gasserian ganglion has been so improved in recent years that they no longer belong to the "kill or cure" class. As a result of a careful study of the anatomical relations of the ganglion and of a better method of exposure, the mortality of these operations has been very materially reduced. While operations which have for their object the extirpation of the ganglion have been practised for a number of years, the recently suggested operation, that of dividing the sensory root, possesses many advantages. Chief among these are: (1) that it should be attended with a lower mortality; (2) that it obviates a number of difficulties; (3) that its execution is, comparatively speaking, simple; and (4) that the integrity of adjacent structures, more particularly the cavernous sinus and sixth nerve, are not endangered. This operation is practically complete when the posterior aspect of the ganglion and its sensory root have been exposed; that is, it is practically completed before one encounters the serious and troublesome difficulties experienced in attempts to extract the ganglion. Apart from these advantages, this procedure would seem to have special

indication in those cases in which there was special reason for believing that the lesion was in the ganglion itself; by severing the connection between the ganglion and the central nervous system, the division of the sensory root is a positive guarantee against the recurrence of pain. The success of this operation depends upon the inability of the sensory root to undergo regeneration, and only after having proved this could one render an absolutely favorable prognosis. Before introducing this operation, which was suggested by my colleague, Dr. Spiller, to the profession, a very thorough and painstaking investigation as to the possibility of regeneration was conducted on the lower animals. The operation, as now practised on the human subject, was repeated by Dr. Spiller and myself upon dogs; the specimens removed after varying intervals subsequent to the operation failed to show the least sign of nerve regeneration. As yet, it has to be proven that regeneration of the central nervous system ever occurs.

The method of performing this operation does not differ materially in its early steps from the operation having for its object the removal of the ganglion. The so-called Hartley-Krause or temporal route is chosen; a horseshoe-shaped musculocutaneous flap is reflected, the zygoma is chiselled through at either extremity in order to obtain freer access to the ganglion, a section of the skull measuring 3 to 4 cm. is removed with gouge and rongeur forceps. Up to this point the operator has no special difficulties with which to contend, but from now on he will be engaged in one of the most difficult operations upon the human subject, and one requiring the maximum of patience. The operator now proceeds to separate the dura from the base of the skull until one of three landmarks appears—the foramen spinosum, from which emerges the middle meningeal artery, which must be carefully avoided or deliberately ligated; the foramen ovale, through which the third branch makes its exit, and the foramen rotundum, through which the second division finds its way out of the skull. These landmarks will usually appear in the order named. While this step of the operation is in process of execution, hemorrhage of varying degrees, but always severe enough to be most troublesome, though never alarming, is the great bugbear. Controllable only by pressure, one must expect to pause many periods of from one to five minutes in order to control the bleeding sufficiently to enable one to recognize the structures. When the margins of the foramen rotundum and ovale are fully exposed, the operator then proceeds to the next step necessary for the exposure of the ganglion, and reflects a flap of the dura propria. This is best accomplished by making an incision through the dura propria between these two foramina, and separating the dura only from the upper surface of the ganglion. It is not necessary to disturb the lower surface of the ganglion in the operation we are describing, and this is fortunate,

because from this surface the ganglion receives most of its blood supply. The dura is to be separated then only from the upper and posterior surface until the sensory root is exposed. Pick the sensory root up on a short blunt hook and remove a small section of the nerve with blunt, curved scissors. With the completion of this step the operation is practically finished. One or two strands of gauze are introduced to afford proper drainage, and the musculocutaneous flap replaced and sutured. I exhibit before you to-day three patients upon whom I have performed this operation as above described. This patient was operated upon over a year ago, and was the first patient upon whom this operation was ever practised. That he has remained entirely free from recurrence is the strongest possible evidence that could be advanced in confirmation of strongest possible evidence that could be advanced in confirmation of the statement which we have made regarding regeneration of the sensory root. The patient now before you is the second case of the series. She was operated upon a few months ago; her convalescence was uninterrupted, and she has continued absolutely free from pain. After the hair grows in, there will be scarcely any disfigurement apparent. The third case was operated upon about five days ago before a limited section of the class. She likewise has given us no cause for alarm. When I remove the dressing you will see the two drainage strips of gauze emerging from either angle of the wound. These I usually leave in situ for from three to five days, since the oozing usually continues for this period of time. The stitches are removed on the sixth day, and on the day following the patient may get up out of bed, and at the expiration of two weeks may leave the hospital.

For the reasons already stated I am inclined to believe that this operation will in time replace the extirpation of the gauglion. Abbe, of New York, has performed an operation which is less radical and less difficult, but its field of usefulness is limited to these cases in which only the second and third divisions are involved. It, likewise, is an intracrastrongest possible evidence that could be advanced in confirmation of

second and third divisions are involved. It, likewise, is an intracranial operation, and consists essentially in the division of the second and third divisions where they are given off from the ganglion, and in the interposition of rubber tissue at the point of division, in order to pre-

vent the severed nerves reuniting with the ganglion.

In the future I should be strongly inclined to practise temporary closure of one common carotid artery as a means of controlling hemorclosure of one common carotid artery as a means of controlling hemorrhage during the exposure of the ganglion. If, as it is claimed, this
preliminary procedure can be carried out without endangering the
patient's life or permanently impairing the function of the brain, it will
prove to be one of the most important contributions to the technique of
these intracranial procedures. Not only will the amount of hemorrhage
be very materially reduced, but the time required to complete the operation will be lessened by at least one-half. I have practised temporary
closure of the common carotid arteries with the most gratifying results

in a number of operations—c. a., in the removal of a brain tumor, in the exeision of superior maxilla and exeision of the tongue-and I see no reason why this blood-saving and time-saving measure should not be taken advantage of in operations upon the ganglion.

- 1. To sum up in a few words the treatment of trifacial neuralgia I would say that in all incipient eases remove the predisposing cause and administer strychnine hypodermically in heroic doses under proper precautions, and with such adjuvants as have been suggested.
- 2. In eases that do not respond to this mode of treatment, where the pain is referred to but one branch, recommend the peripheral operation, even though the operation may have to be repeated. It will afford relief, at least temporarily, in every ease, and in some eases permanently.
- 3. When the peripheral operation has failed to afford but temporary relief, even though it may have been properly executed and repeatedly performed, or when from the onset the pain is referred to two or more branches, recourse should be had at once to an intracranial operation: either division of the sensory root or, in certain selected cases, division of the second and third divisions, with interposition of a foreign substance to prevent reunion.

A DEATH DURING GENERAL ANÆSTHESIA WITH ETHYL CHLORIDE.

BY FRANCIS OLCOTT ALLEY, JR., M.D., OF PHILADELPHIA,

Ox August 11, 1903, there was admitted to the Pennsylvania Hospital a colored man, I. W., aged twenty-eight years, suffering from an incarcerated inguinal hernia. The patient was an epileptic and had had his last convulsion three days before admission. He had had the hernia for three years; it had been easily reducible until ten hours before admission. Since that time he had had pain in the hernia and eonsiderable vomiting, not, however, feeal in character.

Physical examination showed his abdomen greatly distended and

tympanitie, and a large, irreducible serotal hernia on the right side. Temperature was 98.8° F.; pulse small, 110 per minute. Examination was otherwise negative. His general condition was poor.

The hernia could not be reduced, and he was prepared for operation. Anæsthesia was started with ethyl ehloride and progressed satisfaetorily until nareosis was approaching (about three or four minutes), when the change to ether was to be made. About fifteen grams of ethyl ehloride were used. Just as ether was started the patient gagged and vomited an enormous quantity of an almost clear, watery liquid, which, for a time, spouted from his mouth in a continuous stream, without retching or inspiratory effort. The vomiting could not be controlled and must have lasted, with slight intermissions, for two or three minutes. When it finally stopped respiration was not resumed, cyanosis was present, and no pulse could be felt. Artificial respiration, with traction on the tongue, was continued for some minutes without effect; there seemed to be no air entering or leaving the lungs. No obstruction could be felt in the throat or trachea. There had been no solid matter in the vomitus. Permission for an autopsy was refused by the patient's friends.

During the last six months ethyl chloride has been used at the Pennsylvania Hospital quite indiscriminately for inducing general anæsthesia for minor operations or as an antecedent to ether for more prolonged narcosis. The results have been generally satisfactory. In some cases there has been struggling; in one child an epileptiform convulsion occurred during the induction of anæsthesia; in no case, except the one above reported, have there been alarming cardiac or respiratory symptoms. The method has been to spray the chloride of ethyl upon gauze held over the patient's nose and mouth, and the number of such anæsthetizations has been about one hundred.

This case is not reported to condemn ethyl chloride or emphasize its dangers, for it can hardly be held entirely responsible for the fatality; the result might have been the same with any other anæsthetic. The statistics of general anæsthesia with ethyl chloride are given in the Journal of the American Medical Association for November 8, 1902, by Dr. M. W. Ware, who collected 12,436 cases with one bona fide death; and in the Lancet for April 4, 1903, by Dr. W. J. McCardie, who mentions 16,000 cases, collected by Seitz, with one death.

A CASE OF INFECTION OF THE EPIDIDYMIS AND TUNICA VAGINALIS BY THE FRIEDLÄNDER BACILLUS.

BY EUGENE P. BERNSTEIN, M.D., ASSISTANT IN THE PATHOLOGICAL LABORATORY OF THE MOUNT SINAI HOSPITAL, NEW YORK CITY.

Although the literature abounds in observations of infections by the Friedländer bacillus, the number of cases arising in the genitourinary tract is very small. The occurrence of the organism in the respiratory tract, as a causative factor in pneumonia, pleurisy, and empyema is well known, and its etiological sigificance in certain cases of otitis media, meningitis, cholecystitis, and intestinal infection has been established.

Etienne, in an exhaustive article comprising eighty-three cases collected from the literature, describes instances of primary infection in almost every organ of the body. In the genito-urinary tract he describes lesions secondary to a septicemia.

In the cases reported by Canon, Clairmont, Brunner, Weichselbaum, Howard, and Josserand and Bonnet, the Friedländer bacillus was isolated from the kidneys and in two cases from the urine but these cases were not instances of primary infection.

Montt-Sauverdo gives a short account of two cases of cystitis, and Shenk describes a case of bilateral salpingo-oophoritis due to the hacillus

Of more interest are the cases of Halban, Malgaigne and Vauverts. and Chiari. In Halban's case a scrotal hæmatocele became infected and from the pus the Friedländer bacillus was obtained in pure culture. The mode of infection could not be ascertained. Malgaigne and Vauverts found the same organism in both spermatic cords and the urethra in an infection subsequent to an acute specific urethritis. In Chiari's case some doubt exists as to the primary seat of infection. He concludes from a study of his case that the cystitis was the cause of an ascending suppurative pyelonephritis followed by a fatal septicæmia.

When we consider that these few observations represent all that has hitherto been seen in the way of infections of the genito-urinary tract by the Friedläuder bacillus, the following case becomes one of decided interest.

History (abstract). The patient, a male, aged fifty-eight years, was admitted into the Mount Sinai Hospital on July 6, 1902, under the care of Dr. A. A. Berg, to whose kindness I am indebted for the cliuical history.

Family History. Negative.

Previous History. Gonorrhea at the age of twenty-two years and

pneumonia at the age of fifty-one years.

The present history is of three weeks' duration. At that time his right testicle suddenly became swollen, red, and tender. One week later the left testicle was similarly affected, while the inflammation of the right diminished somewhat in severity. He claims to have had no chills or fever. Urination and sexual power normal. There are no

other facts of importance.

Physical Examination. The right testicle is hard, and swollen to about one and a half times its normal size; it is not very tender, nor is there any fluctuation present. The right spermatic cord is distinctly thickeyed. The left testicle is of the size of a large orange and is very tender. The skin over it is glossy and reddened. The consistence of the tumor mass is hard, except at the lower anterior portion, where fluctuation can be felt distinctly. The left spermatic cord is of the thickness of the index finger. There is no urethral discharge. Rectal examination reveals nothing but a slight prostatic hypertrophy. On massaging the seminal vesicles a few drops of purulent-looking secretion appear at the meatus. On examination gonococci are not

The operation, which consisted of incision and drainage of the left tunica vaginalis, revealed the following conditions: The tunica vaginalis is much thickened and filled with a very viscid, yellowish pus.

The epididymis is the site of numerous small abscesses. appears to be normal. Spreads from the pus show a Gram negative, encapsulated bacillus. The cultures will be described later.

Five days after the operation the right testicle began to increase in size, became tender, and showed distinct fluctuation. The seminal vesicles also became much indurated and tender. Aspiration of the

right tunica vaginalis yielded the same viscid, yellowish pus.

At the second operation the right tunica vaginalis was incised and A large pelvic abscess was found on the left side. was evacuated by an incision just above the left Poupart ligament, and a counter-incision was made in the perineum. About fourteen ounces of non-odorous, yellowish pus was evacuated. The left spermatic cord was also incised, and pus, similar to that previously described, was obtained.

It is unnecessary to go into the further clinical history of the case

except to state that the patient made an uneventful recovery.

The urine, which contained many pus cells and a few granular casts, was not examined bacteriologically. The finding of the Friedländer bacillus in it would not have been of much significance, as it might have been infected from the epididymis.

Bacteriological Examination. The findings in the pus obtained at the different operations are all identical. The organism is a nonmotile, facultative anaërobe. Spores and flagella cannot be demon-

The spreads show a rather short, plump, Gram negative bacillus with rounded ends, surrounded by a broad capsule, which is well demonstrated by the ordinary methods for staining capsules (Welch and Weichselbaum) and by the writer's modified Gram stain, which is very well adapted for the demonstration of capsules.1 There is a tendency here and there for the organism to grow in short chains. There is no decided variation in the size of the organisms.

Agar Plates. Macroscopically the superficial colonies are more or less rounded in shape, well elevated above the surface, and show a sharply defined edge. They are rather grayish-white in color, mucoid in appearance, the surface being glossy. The deeper colonies are small,

round or oval, pale yellow or yellowish-gray in color.

On microscopic examination the superficial colonies are of a yellowish-gray color, almost opaque in the centre, and more transparent toward the periphery. The edge is regular and well defined, and the colony as a whole is of a homogeneous structure. The deep colonies are round or oval, of a deep-brown color, with a distinct edge. colony is finely granular and quite opaque.

Surface inoculations on agar show considerable growth in the form of rather diffuse mucoid colonies, which adhere rather tenaciously to each other, being drawn into long threads when an attempt is made to

remove some of the colonies with a platinum loop.

Stick cultures in agar show the growth along the entire puncture, with a diffuse, thick growth over the surface.

¹ The writer's method is as follows: After fixing the specimen, it is stalned with anilinwater-gentian-violet for thirty seconds; the Gram solution is then used for twenty seconds; aleohol until complete decolorization ensues. The specimen is washed in water, and is then eounter-stained for thirty seconds with a 12 per cent. aqueous solution of fuehsin (made from a saturated alcoholie solution).

Gelatin Stick Cultures. Growth along the entire puncture, and diffuse growth on the surface; no gas formation or liquefaction of medium.

Bouillon. Diffuse marked cloudiness, with slight sediment at the

bottom of the tube. Considerable scum on the surface.

Glucose-agar Stick Cultures. Numerous gas bubbles within six hours. Glucose-bouillon (0.5 per cent.) and Saccharose-bouillon (0.5 per cent.). Diffuse cloudiness; slight sediment; no scum formation; distinct acid production in twelve hours. Lactose-bouillon (0.5 per cent.). Growth less marked.

Fermentation Tubes. Glucose-bouillon. Growth in the branch and

in the bulb; acid production marked; gas formation.

Saccharose-bouillon. Growth in the branch and bulb; very marked acid production; more than twice as much gas formation as in the glucose medium.

Lactose-bouillon. No growth in the branch; slight growth in the bulb with alkalinity production.

(All stock bouillon sugar-free. Glucose, saccharose, and lactose media contain 0.5 per cent. of the respective sugars.)

Distinct acid production; no coagulation, even after thirty

days.

Indol. Moderate reaction on the fourth, fifth, sixth, and seventh days; more marked on the eighth day.

Potato. Heavy, prominent, yellowish-gray mucoid growth; gas

bubbles on the surface.

Serum-agar. Very marked growth; more abundant than with

ordinary agar. No precipitation; no gas formation.

On the sugar-serum-agars (devised by Libman) there is a very heavy growth. Precipitation on the glucose and saccharose media with gas

production, but none on the lactose medium.

Serum Reactions. The patient's blood gave no reaction with the organism, either in the form of threads or of clumps, when tested in weak and strong dilutions.

Animal Experiments. Intravenous and intraperitoneal inoculations into rabbits were without apparent effect. Guinea-pigs invariably succumbed within twenty-four hours after intraperitoneal injection, and a very marked general peritonitis, from which the organism was recovered, was always found.

It is evident, from the description which precedes, that the organism found in our case is a typical Friedländer bacillus. It is of interest to note that the organism is more active in splitting up saccharose than it is in splitting up glucose, and that lactose is not at all It has been our experience in the laboratory that this property is quite characteristic of a number of members of the Friedländer group. The presence of a positive indol reaction is in accord with the work of the later investigators. The absence of agglutination or thread formation in the serum test is a rather striking phenomenon in so marked an infection. The point of invasion of the organism remained The moderate severity of the case clinically was in undiscovered. striking contrast to the severity of the infectious process.

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A CASE OF THE EPIPHENOMENA OF DIPHTHERIA ANTITOXIN.

By James P. Marsh, M.D.,

SURGEON TO THE SAMARITAN HOSPITAL, TROY, N. Y.; SURGEON TO THE TROY ORPHAN ASYLUM.

Ir has come to pass that in the ordinary practice of medicine the giving of an injection of antitoxin in a case of diphtheria is regarded as about devoid of all danger. It is true that most of us have occasionally seen a mild urticaria-coming on about forty-eight hours after injection-follow the use of the medicament. A still smaller number of practitioners have seen joint stiffness, endocardial murmurs, and atypical symptoms of acute rheumatism develop anywhere from seven to fourteen days after injection. A few will remember, in a hazy way, of a few cases having been reported in the early days of antitoxin, wherein the reporters attributed the rapid and sudden death of their patients to the antitoxin; but so many times has the remedy been used without mishap that these cases have come to be looked upon as coincidences.

It is, therefore, my purpose in placing the following case on record to call the attention of the profession to the fact that the injection of antitoxin is once in a great while followed by alarming symptoms. It is not to be a doubt cast upon the efficacy and great value of antitoxin, which has now been abundantly proven, but a protest against looking upon an injection of antitoxin in the same light as a hypodermic injection:

On December 14, 1902, Miss W., aged thirty-nine years, and a matron by occupation, noticed that her throat was sore. This condition continued, gradually increasing in severity, until the 18th, when she went to bed, and I was called to see her. A clinical diagnosis of diphtheria was easily arrived at, and arrangements were made to give an injection of antitoxin on the 19th.

There was nothing in the family or personal history of the patient

which is worthy of mention.

At about 11.30 A.M. of December 19th I injected into the subcutaneous tissue of the back of this patient the contents of a bottle labelled: "N. Y. State Department of Health. Diphtheria Antitoxin. 1500 units of Antitoxin, op. No. 1111 A 7. An '02,'" and immediately

took my departure.

About ten minutes after receiving said injection the patient was taken suddenly with a feeling like sulphur fumes in the brouchial tubes, and could not breathe. She is said to have at once become very much cyanosed and semicomatose, and, in fact, her attendant thought that she was in articulo mortis. The patient says that at this time she felt a "numb" feeling extend over her body and that she could not see anything in the room. Next there developed a severe pain in the epigastric region, and the patient vomited, and immediately thereafter a severe itching, stinging rash came out all over the body. As the rash appeared the other symptoms passed away, and the whole process had lasted up to this time about fifteen minutes.

I reached the bedside of the patient about one and one-half hours after the injection of antitoxin had been administered, and found her suffering from a universal urticarial rash, the conjunctive excessively swollen and injected, so much so as to interfere markedly with the

action of the lids.

It took about thirty-six hours for this rash to entirely disappear, and the patient's convalescence was very rapid and uneventful. The action upon the tonsillar membrane was very marked and energetic, the

whole having disappeared in twenty-four hours.

When questioned this patient told me that she had always noticed that while driving behind a horse her eyes would run and that she would be affected by uncontrollable sneezing attacks, and that when she was a young woman she repeatedly had to desist from harnessing her horse because of these attacks.

From a careful questioning of the attendants on this patient I am convinced that this case came very nearly being fatal, and had the

dose been larger death would have certainly occurred.

I am equally clear that the symptoms are not due to the antitoxin per se, but to an idiosyncrasy ou the part of this patient to contact with a horse or anything derived from that animal.

A CASE OF PROBABLE PRIMARY CARCINOMA OF THE LUNG.

BY ARTHUR BREMKEN, M.D., OF SPRING GROVE, ILL.

WHILE in the service of Dr. Bayard Holmes he placed before me the following history of a case which he had seen with Dr. I. C. Anker and Dr. Robert H. Babcock:

Mrs. B., aged fifty years, came under the care of Dr. Anker on November 30, 1901. She had been previously under the care of another physician, complaining of pain in the left chest, and this physician had repeatedly made physical examinations of the chest and had assured her that there was nothing wrong with the lungs or heart. She still felt this pain for which she had consulted the first physician, and it was sharp enough to give rise to uneasiness in her mind, but gave

her no pain or anxiety between the attacks of coughing.

Dr. Anker found a woman, aged fifty years, mother of several children. She had ceased to menstruate ten years ago. She had had no discharge from the uterus and had considered herself during all this time a well woman. She weighed 120 pounds, had brown hair with very little gray, and was in every way a well-preserved woman. Upon the first examination Dr. Anker detected an area of relative dulness in the lower part of the region of the left lung. He suspected tuberculosis and attempted to get an examination of sputum, but she had none. He saw her repeatedly during the following three months, during which time the patient continued to use acetanilid in five-grain doses, three or four times a day, to relieve the attacks of pain which she continued to suffer. During the last of January, 1902, the whole lower half of the left lung seemed to be flat, and the heart seemed to be pressed toward the right. Early in March Dr. Robert Babcock saw her in consultation with Dr. Anker, and found all the physical signs and conditions which Dr. Anker had recognized. He believed that the lung was surrounded by a solid, fibrinous effusion, and that the heart was so displaced that the apex was almost exactly in the middle line. Upon a second visit to her Dr. Babcock suggested the possibility of some fluid exudate at the base of the left lung. On account of his inability to make a diagnosis he recommended that aspiration be under-During all of the time the patient had been under the care of Dr. Anker she never had a temperature above 100° F., and only occasionally a pulse below 100; the pulse ranged between 100 and 110. The urine was repeatedly examined and gave no evidence of abnormal constituents, except in the three or four weeks previous to my visit there was a distinct increase of bile pigment. During the last three weeks the stools were found to be white or clay-colored and free from bile, and in the last four months she has been persistently constipated, and during the last three weeks she has been obliged to have a little heroin to relieve the cough which has troubled her. For three weeks she has complained of indistinct abdominal disturbance and distress in the upper part of the abdomen. This pain was relieved by pressure of her hands or arm. On March 19th I saw her with Dr. Anker and Dr. Kitterman. It was in daylight, and she gave the impression of a woman who had been moderately sick. She was somewhat thin, weighing about 112 pounds. Her complexion was not good, but was not cachectic, and there was a slight trace of jaundice in the conjunctiva. She was suffering from dyspnæa and could only speak in short sentences, broken by rapid breathing. Her lips were blue, but there was a distinct flush on her cheeks. Her pulse was 120 when first She had just had a dose of acetanilid. The pulse presented no unusual character and was found to be approximately the same at both wrists. After removal of the clothing her chest showed a distinct bulging toward the left side. The heart's apex was readily recognized at about the midsternal line. There was distinct curvature of the spine, apparently due to the distention of the left chest. The liver was readily recognized, extending two finger-breadths below the costal arch.

abdominal muscles were fixed and rigid. The area of tympany of the stomach was 1.5 inches above the umbilions and certainly not greater than normal. The upper part of the area of the left lung from the apex to the attachment of the diaphragm below was absolutely flat except for an inner strip near the vertebræ behind and the sternum in front. This area was also devoid of respiratory sounds and without fremitus or vocal transmission. The inner margin next to the sternum and vertebræ gave slight respiratory sounds and slight vocal transmission, but no fremitus could be felt. Percussion and anscultation of the right chest were practically normal, or if abnormal they were puerile or exaggerated. The area of cardiac dulness extended two and a half inches beyond the middle line toward the right and upward for a distance of three inches.

The patient's temperature at this time was 99° F. and had been 99.5° F. in the morning. Her urine had been examined this day, giving no abnormal constituents except an unusually large amount of bile. She had slept moderately well during the night. Her bowels were moved by saline cathartics; the stools were clay-colored. She had no difficulty in swallowing, but was obliged to eat slowly on account of the dyspnœa.

On withdrawing a drop of blood for examination, it appeared to be very dark colored and venous. It flowed readily enough. The count gave 15,000 leucocytes per c.mm. No red count was made nor was

hæmoglobin estimated.

After removing a local application from the left side of the chest the skin was scrubbed and local anæsthesia produced by injecting a dilute solution of cocaine into the skin and deep tissues of the chest wall. A trocar about 1 mm. in diameter was introduced between the fourth and fifth ribs in the axillary line. Before the trocar was removed a bloody serum began to pour out between it and the cannula. After withdrawing the trocar eight ounces of fluid were collected in a clean glass for examination, and afterward thirty-two ounces were allowed to run out in an intermittent stream after contraction of the abdomen and upward compression of the diaphragm. The patient was in a sitting position during this operation. After the stream began to flow more slowly the cannula was removed for fear of introducing infection. The patient immediately improved in voice and respiration after this fluid had been removed. The heart was found to have moved at least one inch toward the left, but there seemed to be no increase in resonance over the left The apex was especially flat.

Three weeks later the dyspnea had returned and the Bunsen pump was used to empty the left thorax again; but, naturally, the amount of fluid removed could not be determined. When the vacuum became considerable the patient complained so much of pain and cardiac distress that the operation was arrested. The findings were the same as before. Examination of the fluid showed: specific gravity, 1025; reaction alkaline; urea, 0.2 per cent.; a large amount of albumin, a few lenkocytes, mostly lymphocytes, and erythrocytes 8400 per c.mm. After this no further attempt was made to secure expansion of the lung. The patient died August 31st, and the autopsy was made by Dr. Anker:

Left pleural cavity contained about three pints of thick, bloody fluid of a brownish-red color. No adhesions were present. The left lung was about the size of two hen's eggs. The upper portion or lobe was very friable and bloody; the lower portion was rather hard to the touch and contained considerable blood. The parietal pleura was smooth and glistening. No enlarged lymph glands were found in the mediastinum.

The parietal and visceral pleuræ of the right pleural cavity were smooth and glistening. There were no adhesions. No enlarged lymph glands were found. The lung was about one-third the normal size. Small white miliary nodules were seen in the visceral pleura.

The apex of the heart was in the sternal line. There were no adhe-

sions. No further notations were made.

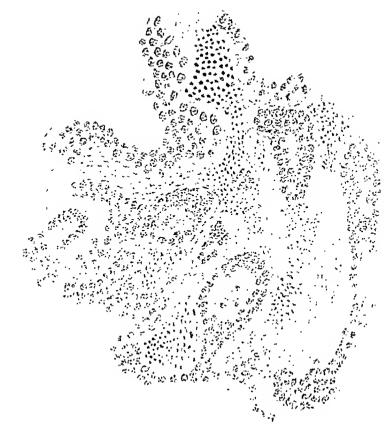
The aorta was bound to the surrounding structures, particularly to the posterior wall of the thorax, and appeared to be atheromatous.

The diaphragm was thickened throughout, but more particularly on the left side, and it could plainly be seen that the thickening was due to the neoplastic invasion. The aorta, diaphragm, and heart were bound together apparently by the tissue that caused the thickening of the diaphragm. No adhesions were found in the peritoneal cavity. The peritoneum was smooth and glistening and no fluid was found in the peritoneal cavity. The omentum was uniformly thickened, somewhat nodular, and showed small areas of fat. The liver was apparently normal in size and outline. The gall-bladder presented no adhesions. It was greatly distended with a translucent material. Its walls appeared slightly thickened. There were no adhesions about the stomach, no tumor in the pylorus, and no enlarged lymph glands about it. The intestines, spleen, paucreas, and kidneys were examined and showed no apparent anatomical changes.

I made the pathological studies which follow and such drawings as illustrate the findings in a large series of sections stained by various methods:

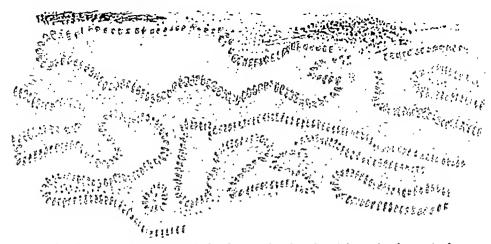
A section from an area of consolidation including the margin of the lung shows irregular islands of epithelial cells. These cells are separated from each other by a connective-tissue stroma, rich in well-staining connective-tissue nuclei. Finger-like projections of the stroma are The arrangement of the cells in the groups is always more or less characteristic. The outer layer of cells or those in contact with the stroma are cylindrical, while the others or those lying internal to this layer are more or less irregular in outline, and they vary in size. As we reach the periphery of the tumor an entirely different picture Here it attains the type of a cystoadenocarcinoma presents itself. (Figs. 1 and 2). The cyst-like spaces here are lined with a single layer of columnar epithelium. An amorphous eosin staining material fills these spaces, in the meshes of which roundish cells are occasionally seen, about the size of large lymphocytes. These stain faintly with This amorphous material is seen now and then in the large masses of epithelium in the deeper parts of the tumor (Fig. 1). The nuclei of the tumor cells vary somewhat in size and shape. They usually stain well with hæmatoxylin and show nucleoli. Degenerative changes in these cells occasionally appear, especially in the large masses Karyokinetic figures are met with. The bloodvessels in this area show proliferative changes in the intima, apparently endarteritis oblitcrans, in many cases occluding the lumina. Black pigment





Drawing from tumor in left lung, from the most solidified portion, showing the characteristics of carcinoma. Oc. 4, obj. 7, Leitz.

Fig. 2.



Drawing from a section of tumor in left lung at its pleural periphera, showing cystoadenocarcinoma. Oc. 4, obj. 7, Leltz.

is sometimes found in the stroma, and is deposited in moderate amount around the bloodvessels. Small round-cell infiltration is found everywhere.

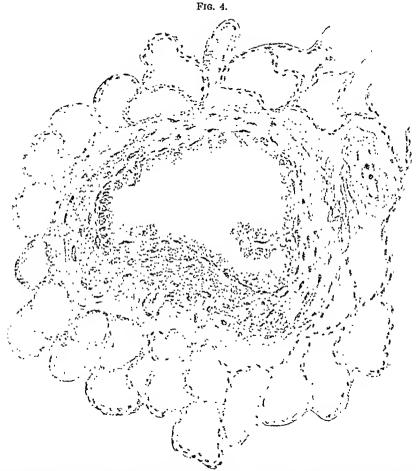
A section of lung in the vicinity of diffuse consolidation shows in a general way the same findings—adenocarcinoma. In this region the alveoli are in many places filled with cylindrical epithelial cells. A single layer of tumor cells lines the alveolar wall. Many transverse sections of bloodvessels are met with; they are mostly empty. Around many of them (especially around the larger ones) the invasion of the tumor



Drawing from solidified area of left lung, showing irregular channel, which in all probability is a bronchus, containing finger-like projections of epithelium. Oc. 4, obj. 3, Leitz.

cells into the adventitia is to be seen. Small bronchi are observed; their lining epithelium is usually intact. Peribronchial round-cell infiltration, which many times extends through the entire wall of the bronchus and impinges on the lumen displacing the epithelium, is often recognized. Lying in the meshes of the invaded lung, surrounded with the tumor cells, is to be seen an irregularly outlined channel, appearing as though it were compressed by the surrounding mass. In the wall of this channel are rather oblong nuclei, which stain fairly well with hæmatoxylin and appear to be granular. From their size and general appearance one would say they were muscle nuclei, and would come to

the conclusion that the channel was a bronchus. Within the lumen we see epithelial cells, which are more or less cylindrical and simulate those normally found lining a bronchus. There is more than one layer of these cells in places. Extending into the lumen of this channel one sees what appears to be a proliferation of these cells into finger-like projections. In one corner a mass of these lie, seemingly unattached to the wall (Fig. 3). A channel corresponding in its histological appearance to the one above described is seen in a part of the lung

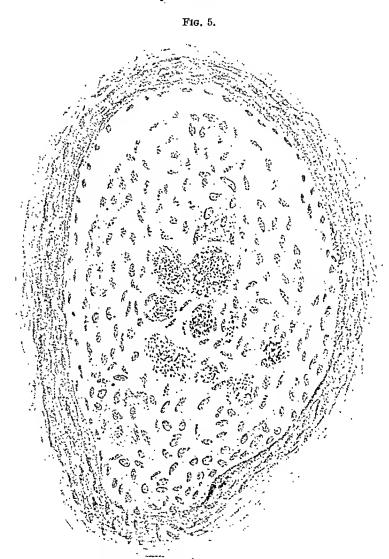


Drawing from left lung remote from diffuse infiltration, showing transverse section of bronchus with a papillary node projecting into its lumen. Oc. 4, obj. 7, Leitz.

remote from the diffuse infiltration. It is irregular in outline and lies beside a bloodvessel. It is probably a bronchus. A distinct papillary node, lined with cylindrical cells, is seen projecting into the lumen. A direct connection with the wall is demonstrable (Fig. 4).

A section of lung remote from consolidation shows a tendency to peripheral distribution of metastases. It shows also how the alveoli are invaded, some being only partially filled, while others are filled to distention. Those alveoli that are not invaded by the tumor cells are usually markedly distended, giving the picture that is seen in employema.

Throughout this area is seen desquamation of the alveolar epithelium. These desquamated cells are always filled with a brown pigment. Lymph spaces in the alveolar septa and subpleural lymph spaces are occasionally distended with lymphocytes and black pigment. The bloodvessels in this section are always filled with blood. The picture of endarteritis is present in many of them.



Drawing from bloodyessel in right lung, showing proliferation of endothelium in a tumor-like manner, simulating the pieture of endothelioma. Oc. 4, Leitz.

A section from the right lung shows peripheral metastases into the alveoli. The cells usually form but a single layer around the alveolar wall. Small areas of pneumonia are occasionally seen in the right lung. Pigmented desquamated alveolar cells are found throughout. The bloodvessels are always engorged with blood. Here, as in the left lung, endarteritis obliterans is present. Nodes of proliferated endothelium extend into the lumen and divide the vessel into two channels. Near the margin

of the lung is seen a relatively large bloodvessel, with a rather thin wall for so large a lumen (Fig. 5). The entire vessel is filled with a tumor-like mass apparently springing from its endothelial lining. It is attached at the lower margin. The endothelial cells that have proliferated have produced the picture of an endotheliana. Brownish pigment is present in the central portion, illustrating beautifully complete organization of a thrombus. Perivascular lymph spaces in this section are occasionally filled with the tumor cells.

The tumor in the omentum attains throughout more the type of a cystoadenocarcinoma. The cyst-like spaces are larger, some being entirely empty, while others are filled with an amorphous eosin staining material. The stroma is here composed of a more delicate framework, and gives the general appearance of lymphadenoid structure. In many places small distinct openings are seen always lined with endothelial cells. Some of these openings are filled with lymphocytes, others are empty, and many are filled with tumor cells. The stroma is densely infiltrated with lymphocytes. Here and there are small areas of fat cells, around which there is always a dense leukocytic infiltration. Between the fat cells there are rows of infiltrating tumor cells. The bloodvessels here usually have thin walls and otherwise appear normal. They do not show the changes observed in the bloodvessels of the lungs. They are usually distended with red blood corpuscles, but no thrombus formation. Perivascular leucocytic infiltration is everywhere to be seen.

A section through the thickened diaphragm shows that the thickening is entirely due to the neoplastic invasion. The tumor is seen at one point penetrating the muscular tissue from one surface to the other—adenocarcinoma displacing the muscle fibres. Isolated muscle fibres are present in the new-growth. In its progress through the diaphragm the tumor has produced a pressure atrophy of the muscle fibres. Many fibres are less than one-third their normal size. Leukocytic infiltration is present in a moderate amount throughout the section, especially surrounding the invading tumor tissue.

The liver shows no changes aside from a moderate degree of fatty infiltration and deposition of a brown pigment in the liver cells. The nuclei stain well everywhere with hæmatoxylin.

The gall-bladder specimen was lost, but showed no changes anatomi-

cally.

Sections of lung and the tumor in the omentum were stained by Weigert's method for elastic fibres. These sections show plainly that the elastic fibres have extensively proliferated. Everywhere throughout the section from an area of consolidation in the lung the heavy bands of connective tissue forming the stroma are rich in elastic fibres. That the alveolar wall forms in many places the stroma of the tumor is now very evident, as the elastic fibres normally present still hold their general appearance in the alveolar septa.

The omental tumor shows the absence of clastic fibres except in the bloodyessels and their immediate vicinity; only rarely do they extend into the stroma, and when fibres are thus seen they are very thin.

That the elastic fibres proliferate in the process of endarteritis obliterans is plainly shown; a very fine fibrillary network of clastic fibres is seen branching from the internal elastic lamina and extending into the thickened intima for some distance, but nowhere does it reach the extreme inner margin.

The tumor-like proliferation of endothelium described as occurring in the right lung does not present the same picture, but shows that the elastic fibres have not proliferated to any considerable degree.

The autopsy and the microscopic study show the source of all the clinical symptoms and findings. The only question left to answer is, Where and how did this tumor originate? The history of this case does not show any previous disease of the lung or bronchi with subsequent scar formation, such as tuberculous or syphilitic ulcers, the scars of which are supposed to be predisposing factors in the etiology of bronchial cancer. The duration of the disease was rather long-almost two years, if we assume that the first symptoms were due to cancer. The character of the epithelium of the tumor is such that it may have originated from a bronchus, and in one place I have described a node projecting into the lumen of a bronchus, which may have been the origin of the tumor. This is not certain, however. There is no evidence of carcinoma elsewhere in the body except the thickening of the diaphragm, which is due to carcinoma, and the tumor in the omentum. Such a tumor could not originate in the omentum. Taking into consideration the fact that no tumor was found in the stomach, liver, pancreas, kidneys, and intestines, and that the symptoms from the start were directly referable to the left lung, where the tumor was found, I believe we have sufficient evidence to say that this is probably a primary cancer of the lung. There is no likelihood that it was secondary to a tumor which remained dormant during the two years of her sickness. Primary carcinomata of the lung are rare, but not exceptional. In reading the literature there are perhaps more than seventy-five well-reported and credible primary carcinomata of the lung. The symptoms, course, findings, and general picture of this case correspond with those reported by other observers. This case is reported because it has considerable clinical and pathological interest, and in the hope of encouraging fuller reports of such exceptional cases.

THE MOVEMENTS OF SUPERIOR INTERCOSTAL MUSCLES IN HEMIPLEGICS.

BY L. PIERCE CLARK, M.D.,
CLINICAL ASSISTANT IN NERVOUS DEPARTMENT, VANDERBILT CLINIC (COLUMBIA COLLEGE),
OF NEW YORK.

THE present accepted opinion of the respiratory movements in hemiplegics is well stated by Gowers, who says that "The two sides of the thorax move equally in ordinary respiration, but if the patient

¹ Diseases of the Nervous System, vol. ii. p. 75.

takes a deep breath and brings into action the extraordinary muscles of respiration the half of the thorax on the paralyzed side often expands less than the other. Thus, some muscles are completely paralyzed, others are merely weakened, others are apparently unaffected."

These rules are based upon the well-known Broadbent hypothesis, that bilaterally acting muscles are represented bilaterally in the cerebral cortex. There is a failure to note, however, that the movements on the sound side in extraordinary respiration are always greater, which modifies Broadbent's hypothesis so to state that even bilaterally acting muscles, although represented bilaterally, are represented contralaterally to a greater degree.

In 1895 Hughlings Jackson' stated that the superior intercostals play a more or less constant rôle in the syndrome of hemiplegics, contrary to the universally accepted opinion as given in quotation from Gowers. He believed that in ordinary or automatic respiration the amplitude of superior intercostal movements was greater on the paralyzed side than on the other; while in volitional (cerebral) movements, such as that of forced conscious or extraordinary respiration, the usual law of greater movements of the sound side would be found. To substantiate this he reported observations on twenty-eight cases of old and recent hemiplegics, in which the greater number of cases (eightcen in twenty-eight) proved the accuracy of his theory.

Recently I had opportunity to re-examine some cases that were thought to negative the law, but after giving considerable attention to the necessary technique I found they were no exceptions to the law. I have furthermore examined 161 cases of hemiplegia in the Craig Colony, in hospitals, and at the Vanderbilt Clinic of this city, to make certain the constancy of this respiratory symptom in hemiplegics. The value of the sign if present in all destructive capsular lesions is obvious. I examined 120 consecutive cases of the series of 161, and the remainder were made under my direction.²

As a result of this clinical study I found the sign uniformly present in all without any apparent relationship to age, character, duration, or severity of capsular lesion (aside from its being hemiplegic in range). The double change (first, overaction on paralyzed side in automatic respiration, and the second shown in the converse in extraordinary or volitional respiration) was very marked in some and very slight in others; the difference, however, was only one of degree. In all cases the symptom can be detected by palpation, and in most cases even by inspection alone.

The explanation for the phenomenon is as follows: In destructive

¹ Lancet, February 23, 1895, Neurological Fragments, No. 15.

² I am particularly indebted to Drs. Witmer, Young, Palmer, and Shanahan for assistance in collecting data for this clinical report.

lesions of the internal capsule causing paralysis, hemiplegic in character, the cortical inhibitory control over the medullary respiratory centre of the paralyzed side is destroyed in greater part, at least, much more so on the hemiplegic side than to that centre presiding over the sound side; in consequence of this withdrawal the uninhibited medullary centre overacts in automatic or ordinary respiration, hence the excess movements on the paralyzed side. But in forced conscious or volitional (cerebral) respiration the movements of the thorax on the opposite sound (or nearly so) side are greater.¹

As to the location of the inhibition centre for respiration in the cortex, W. G. Spencer² has demonstrated by electrical stimulation of the cortex in monkeys that slowing and final arrest of respiratory rhythm was produced by excitation of the cortex just outside the olfactory tract, in front of the point where it joins the temporosphenoidal lobe, and the nerve fibres from this region run in a parallel direction with fibres of the olfactory limb in the anterior commissure; after decussating here the tract is continued backward on either side of the infundibulum into the red nucleus below and external to the aqueduct at a plane of the exit of the third nerve. Therefore, we must have a destruction of this centre or its tract in the capsular lesion which results in automatic overaction of superior intercostals on the paralyzed side. (The many interesting speculations relating to the connection between the sense of olfaction and that of cortical respiratory inhibition are at once suggested.) Furthermore, it should be noted that Spencer's valuable and carefully conducted experiments show an acceleration centre which must remain intact and operative in the hemiplegics. In locating the last-named centre in the monkey's cortex he demonstrated that increased action or respiratory acceleration resulted by electrical stimulation of the posterior portion of the sensorimotor area of the cortex. Fibres from this centre were followed back just below the lenticular nucleus where it borders on the outer and ventral portion of the internal capsule; they run at first external and then ventral to the motor portion of the internal capsule, and so reach the tegmentum. The tract from the two sides meet in the interpeduncular gray matter at the level of and just behind the exit of the third nerve. The exact manner in which these cerebral tracts join the respiratory nucleus has not yet been determined either experimentally or pathologically. Even the motor cerebral distribution to the third, fourth, sixth, ninth, and tenth has not yet been worked out. But that they possess as definitely a cerebral supply as the remaining cranial nerves may be con-

¹ In a later communication Jackson states that inasmuch as he did not find the symptom present in every case there were many difficulties to the acceptance of the hypothesis for even some cases of hemiplegia.

² Lancet, December 16, 1899.

jectured. Barnes' has recently suggested that the cerebral motor supply to the ninth and tenth cranial nerves may be through Pick's bundle, a course which, if true, must be entirely different from that given by Spencer's respiratory tract.

Of Spencer's two centres the inhibitory one is anterior and internal, and consequently its damage would be expected in vascular lesions, especially of the middle cerebral artery affecting the integrity of the capsular fibres, while the acceleration centre is posterior and external to the capsule and might easily remain unimpaired.2 On the whole, Spencer's work explains the new respiratory symptom in hemiplegics. The fact that the superior intercostals of the paralyzed side are energy ated through cerebral fibres ending on spinal centres in the anterior horns of the cord, and the more or less marked damage of the same will account for the general motor loss of volitional acts on the hemiplegic side. To further substantiate the anatomical fact of a double enervation of the intercostals, Jackson has suggested also that the increased respiration in early stages of surgical anæsthesia is owing to impairment or loss of function of Spencer's cortical arrest centres. I have seen one case of double hemiplegia (paralysis on the two sides occurring three days apart) in which there was typical acceleration of respiration so marked in degree that the house physician noted the patient appeared as "though going under an anæsthetic." Another case of double hemiplegia did not show this (since the lesion on the two sides was sustained several years apart and adaptation to the first lesion had taken place before the second occurred). The respiratory symptom was present on the side most paralyzed, although it was slight, as would be expected. In the status epilepticus increased respiratory frequency is commensurate with the degree of general cerebral exhaustion, an analogue of general anæsthesia so far as the inhibitory power of the cortex is concerned; finally, Cheyne-Stokes respiration occurs frequently in status without prognosis being so grave as in the other conditions of its occurrence.

The principle underlying the respiratory sign has a wider application than was first thought; it may be demonstrated in any and all muscles bilaterally susceptible of both automatic and volitional movements. It occurs in the seventh cranial nerve in volitional and emotional acts, where it is well known that a slight movement is more conspicuous on the parts paralyzed on the affected side, while a strong one is far less in degree. It also occurs in the action of the third division of the fifth nerve (masseters), and in the act of swallowing, the function of the ninth cranial.

¹ Brain, Winter Number, 1902.

It is just possible that the accelerator centre may be involved in those very posterior lesions of the capsule and thus negative the law in rare cases, but I have not seen such a case as yet.

In many cases it is possible to demonstrate definitely by palpation the inclusion of all chest muscles on the paralyzed side in the new phenomena noted alone for the superior intercostals. I am certain more careful means for detecting this slight difference will show that all the so-called muscles of ordinary respiration enter the hemiplegic syndrome. Jackson mentions one case illustrating this fact which was observed by him.

The necessity for accurate confirmation of the exact location of Spencer's two respiratory centres by means of degeneration experiments and the course which tracts take from such centres to the respiratory nucleus in the medulla is obvious.

A NOTE ON THE FOOT OF THE AMERICAN NEGRO.1

BY ALBERT H. FREIBERG, M.D.,

AND

J. HENRY SCHROEDER, M.D., of cincinnati, ohio.

IT would appear that the widespread notion of the flatness of the negro's foot had its origin in this country. The bones of the negro's normal foot differ in no regard from the white man's as far as their individual shapes are concerned, excepting that of the os calcis, the length of whose posterior process is admittedly greater in the negro. Nevertheless, the flatness of the negro's foot has become proverbial, and has given rise to the saying that "the hollow of his foot makes a hole in the ground." As a racial characteristic of the aboriginal negro, the flatness of the plantar arches has been disproved by Herz and Muskat in recent publications. The former has shown conclusively in a large number of observations made in Africa that a well developed and easily apparent plantar arch exists far more constantly in the negro as there found than in an equal number of Europeans. While this is doubtless true, there can, on the other hand, be little uncertainty that the homely observation of the contrary condition in the American negro has some basis in fact. Abundant opportunity for superficial examination of adult negro feet in this country brings with it the impression that flat foot is present in the negro with unusual frequency as compared with the white. The present investigation is offered as incomplete, in so far as the number of observations is too small for binding conclusions, but as being rather convincing in its results, nevertheless.

¹ Presented to the American Orthopedie Association, May, 1903.

There were used as material for the observations herewith presented eighty-eight feet of adult negroes who were walking patients in the wards of the Cincinnati Hospital. A large proportion of them were under treatment for venereal disease. Eight of these forty-four were women. The men were practically all engaged in heavy laboring occupations. Impressions of the feet were taken by the iron and tannic acid method. Attention was paid particularly to the flatness as shown by the impression and to the condition of the great toe. Of this series but 16.2 per cent. of the feet lacked both hallux valgus and marked flattening of the arch. Hallux valgus without descent of the arch was present in 27 per cent., while marked flat foot was observed in 56.8 per cent. Of the cases of flat foot 92 per cent. had accompanying hallux valgus.

For the sake of comparison a series of impressions of the feet of white patients was taken. Their occupations were noted and were found to be about the same as those of the negroes. Thirty-four feet were examined in twelve men and five women. Of this number 59.2 per cent. had neither hallux valgus nor flat foot. Hallux valgus without flat foot was present in 35 per cent., while but 5.8 per cent. had flat foot, being two cases in both of which hallux valgus was present. It was furthermore noted that 41 per cent. of the white feet presented hallux valgus, with or without flatness, while in the negroes this percentage was 79.5. This frequency of hallux valgus seems of special importance, since it may be considered purely as the result of deforming foot gear.

Although, as before remarked, the number of observations is too small for definite conclusions, the variation in the figures is quite striking. Not only is flat foot much more common in the negro, comparatively speaking, but distortion of the great toe is relatively twice as frequent as in the white.

In the belief that an interesting comparison would result, impressions were taken of the feet of twenty colored children between the ages of thirteen and three years. Of the forty feet examined 75 per cent. had normal feet; 25 per cent. had flat foot, of which 80 per cent. were associated with hallux valgus. Hallux valgus was present in 25 per cent. of the whole number.

By far the greater number of negroes in Cincinnati have more or less admixture of white blood in them. On this account note was made of the color of all the adult negroes examined. There were noted as dark 34, as of medium or light color 54. Of those noted as dark 53 per cent. had flat foot and 70.5 per cent. had toe valgus. Of those classed as medium and light 59 per cent. had flat foot, while 87 per cent. had toe valgus. It would thus appear that these deformities were somewhat more frequent in the lighter colored than in the dark,

although the difference cannot be considered great. In fact it appears that, considering the small number involved, this difference can be ignored.

Were the number of observations sufficiently large it would seem justifiable to draw the following inferences:

- 1. Flattening of the arch of the foot is much more frequent in the American negro than in his white neighbor.
- 2. Hallux valgus is likewise more frequent in the negro than in the white American.
- 3. The well-arched foot occurs in the American negro with sufficient frequency to establish it as the normal.
- 4. While flattening of the arch is more common in the negro child than in the white, the normal foot preponderates decidedly.
- 5. From this it would be fair to conclude that the flat foot of the adult American negro has developed after the period of childhood in the greater number of cases.
- 6. The deforming effects of footwear are much more evident in the adult negro than in the white man of the same class. This is shown by the fact that decided valgus of the great toe is much more frequent.

There require to be explained the cause of the frequency of flat foot in the negro child and its increase in adult life. The great frequency of rickets in negro children is well recognized, and its manifestation in bowlegs and knock-knee is quite familiar. This alone would account for a considerable portion of the flat foot in children. However, it will be noted that even in these hallux valgus was present in 80 per cent. of the flat-footed. This, together with the marked frequency of hallux valgus in the adult, would make it seem likely that the effect of shoes in distorting the feet is especially marked in the negro, both child and adult. This might be explained by the fact that the negro foot is wide in its anterior portion, and, therefore, especially prone to compression. The length of the heel would, however, seem also to merit consideration. It would have the effect of shortening the shoe for the forepart of the foot, since it virtually displaces the ankle forward.

It would seem that a negro's foot cannot be covered with a white man's shoe with impunity.

Should future investigation agree with the above findings it would become necessary to abandon the idea that a flat plantar arch is an hereditary and racial characteristic of the American negro, but this condition would have to be regarded, in part at least, as the injurious result of shoes of improper construction.

The excuse for presenting so incomplete an inquiry is to stimulate further research into a question of importance, not only in its purely

ethnological aspects, but also as it pertains to the theory of development of one of the most frequent deformities of all civilized people.

		Adult negro.		Ad	Adult white.		Negro children.	
Number of feet examined			88		34		40	
Percentage of flat feet			56.8		5.8		25	
Hallux valgus without flat foot			27.0 per	ct.	35.0 per	ct.	5 p	er ct.
Without flat foot or hallux valgus			16.2	4.5	59.2	6.6	75	41
Hallux valgus present in			79.5	44	41.0	* *	25	**
Of flat feet hallux valgus present is	1	•	92.0	tt	100.0	**	80	"

STUDIES ON THE ANTAGONISTIC ACTION OF DRUGS.

By H. D. HASKINS, M.D., of cleveland, ohio.

WITH AN INTRODUCTION BY TORALD SOLLMAN, M.D. (From the Pharmacological Laboratory of Western Reserve University, Cleveland, Ohio.)

I. INTRODUCTION

THE question whether a drug which excites a given structure can remove the effects of another drug which depresses the same structure cannot be considered as answered. Recent cyidence—as the work of J. C. Rothberger on the antagonism of physostigmine and curare. and that of A. P. Mathews' on atropine and pilocarpine, and that of Stokvis3 on digitalin and quinine—favors this view, without being entirely decisive. Accepting the theoretical possibility that an excitant can remove the symptoms produced by a depressant, there still remains the question whether the excitant really removes the depression or whether it only masks it through the excitation. It would seem, a priori, that the former can only be the case when the excitant prevents the depressant from combining with the protoplasm, as, for instance, when an alkali prevents the action of an acid. In these cases the antagonism is chemical or physical. If, however, both the depressant and the excitant combine with the protoplasm, as is supposed to be the case when, for example, pilocarpine and atropine act simultaneously, it must be assumed that they both produce their action. If in this case no noticeable phenomena result, this is not because the drugs exert no action, but because the resultant of the actions is zero. example, it is quite easily conceivable that a cell depressed through starvation may be restored temporarily to its original activity, say by an increase of temperature, and may for a time behave like a normal cell. Nevertheless, it is far from normal; it will probably show chemical, functional, and structural changes, and will, for instance, fatigue

¹ Pfluger's Archiv, 1901, Bd. lxxxvii. p. 117.

² American Journal of Physiology, vol. vi. p. 207.

² Virchow's Festschrift, 1891, Bd. fil. p. 349.

more readily. Similarly, if we assume that the biogen-pilocarpine compound functionates very actively, the biogen-atropine compound

very sluggishly, then the biogen atropine compound may function-

ate very nearly like the free biogen molecule. Nevertheless, a chemical difference must exist between the compound and the free biogen molecule, and this difference must entail other differences in the chemistry, functions, or morphology of the cell. The discovery of such differences in cases in which a complete physiological antagonism is assumed would go far to support this thesis.

Dr. Haskins, at my suggestion, undertook the investigation of some such phenomena, the results of his work being detailed in the following papers:

The histological changes which alcohol is believed to produce in nerve cells seemed to offer a fit object for this study, the question being, Whether a drug which lessens the toxic effects of alcohol also lessens the histological lesions. Since strychnine is credited with counteracting the physiological effects of alcohol, it was chosen as an antidote. It may be said at once that the results throw no light upon the question: first, because the alcohol did not produce the lesions which are credited to it; and, secondly, because strychnine did not prove to be very efficient in preventing the alcohol symptoms. The data seem of sufficient practical interest in other directions to merit reporting.

It was then planned to investigate the subject along an entirely different line, by studying the effect of the simultaneous action of stimulants and depressants on yeast cultures. As no reliable stimulant could be found among drugs, various degrees of heat were resorted to, and were contrasted with the depressant action of strychnine. The results show that the antagonism is far from being as simple a phenomenon as one would expect if the stimulant action of heat neutralized the depressant effect of strychnine. They are more in agreement with the complicated condition which would obtain if the stimulation and depression were superimposed. It must be granted that the stimulation by heat may be of quite a different nature from stimulation by drugs. It must also be granted that there may be various types of physiological antagonism among drugs. These are matters which caunot be considered as definitely settled until a large number of antagonisms have been studied in detail.

II. THE EFFECT OF STRYCHNINE ON ALCOHOL POISONING.

Experiment 1. Summary. Two guinea pigs were each given 40 c.c. of 40 per cent. alcohol per kilo body-weight by intraperitoneal injection, divided into seven doses, during a period of twelve hours. This sufficed to kill one of them. The surviving guinea-pig had been given

in addition to the alcohol 0.15 mg. of strychnine sulphate per kilo weight subentaneously in a 1:20,000 solution, also divided into seven doses.

Two healthy guinea-pigs were selected-A, weighing 290 Protocol.gm.; B, 350 gm. 8 A.M., 10 c.c. of 40 per cent. alcohol per kilo weight injected into A and B; also 0.1 mg. of strychnine sulphate per kilo weight into B. Ten minutes later B lies in a stupor and has rhythmical tremors of the legs. One hour after injection, B the same; A has shown little effect from the alcohol aside from restlessness and occasional shivering; respiration of A, 65; of B, 85 per minute. hours after injection A has almost recovered from his indisposition.

while B has but partially recovered.

10 A.M., the second injection: A and B are given 5 c.c. of 40 per cent. alcohol per kilo weight; B also 0.025 mg, of strychnine sulphate per kilo weight. Five minutes later A has become indisposed. B lies in complete stupor, and exhibits the same tremors. During the next hour A gradually becomes partly paralyzed so that he cannot stand nor walk; B remains the same as before. Respiration of A keeps at about 60, of B at 70 per minute. Finally A lies over onto his side in a stupor, and has tremors of exactly the same rhythm as B. Four and one-half hours after the injection both have recovered considerably, but A is more relaxed and indisposed than B.

2.30 P.M., the third injection: A and B receive 5 c.c. of 40 per cent. alcohol per kilo weight; B also receives 0.0125 mg. of strychnine sulphate per kilo weight. A becomes narcotized much more quickly than Fifteen minutes after injection both present the same symptoms as after the previous injection, namely, stupor and tremors. Respiration of A is 40, of B 80 per minute. Two and one-half hours after injection

they are in the same condition.

5 P.M., the fourth injection of the same dosage as the third. Within a few minutes A ceases to have tremors and begins breathing by gasps. One and one-half hours after injection A seems to be paralyzed completely as far as voluntary muscles are concerned, since he lies relaxed and motionless. Respiration of A is 28, of B 65 per minute. B lies in the same condition as before.

7 P.M., the fifth injection: A and B receive 5 c.c. of 40 per cent.

alcohol per kilo weight. No more strychnine is given.

7.20 P.M., the sixth injection, same as fifth.

7.30 P.M., the seventh injection, same as fifth and sixth. Respiration of A is 10, of B 17 per minute. A is evidently almost dead. is weaker, but has the leg movements still.

8 P.M., A is dead; B is alive and not fully paralyzed. B is killed. Both animals are dissected and portions of the central nervous system

removed for histological examination.

Experiment 2. Summary. Two cats were each given intraperitoneally 20 c.c. of 40 per cent. alcohol per kilo body-weight in two doses of 10 c.c., five and one-half hours apart. One cat received in addition 0.1 mg. per kilo weight of strychnine sulphate in 1:20,000 solution subcutancously in three doses. The latter died during the night. other cat died forty-six and one half hours after the first injection.

Protocol. Two cats were taken, Cat 1 weighing 2980 gm., Cat 2 Cut 2 was not perfectly healthy, as evidenced by a dis-2180 gm.

charge from the eyes.

9 A.M., Cat 1, pulse 100, respiration 40. Cat 2, pulse 108, respiration 48.

9.30 a.m., first injection intraperitoneally into Cat 1 and Cat 2 of 10 c.c. of 40 per cent. alcohol per kilo weight and 0.025 mg. of strychnine sulphate per kilo weight subcutaneously into Cat 2. Seven minutes later Cat 1 shows beginning narcosis. Thirteen minutes are required to make Cat 2 lie down quietly. Fifty minutes after the injection, pulse of Cat 1 is 96, of Cat 2 is 100 per minute; both are completely paralyzed in the hind legs. One and one-half hours after injection both lie quietly sleeping, Cat 1, pulse 100, respiration 80; Cat 2, pulse 120, respiration 45. Two hours after injection Cat 2 receives another dose of strychnine of the same size as before. Two and one-half hours after first injection, Cat 1, pulse 120, respiration 68; Cat 2, pulse 120, respiration 36. Five hours after injection Cat 1 shows partial recovery. Cat 1, pulse 120, respiration 52; Cat 2, pulse 120; respiration 36.

3 P.M., second injection into Cat 1 and Cat 2 of 10 c.c. of 40 per cent. alcohol per kilo weight and of 0.05 mg. of strychnine sulphate into Cat 2. Both lie relaxed within a few minutes. Fifteen minutes after injection, Cat 1, pulse 120, respiration 72; Cat 2, pulse 120, respiration 48. One and one-quarter hours after injection both lying unconscious still. Cat 1, pulse 120, respiration 68; Cat 2, pulse 120, respiration 32. One-quarter of an hour later Cat 2 begins to gasp, and respiration stops within a few minutes, then begins again at the

rate of 16 per minute.

Cat 2 died during the night.

Cat 1 lay unconscious all the next day, but could be aroused somewhat; the respiration varied from 44 at 8 A.M., 26 at 2.30 P.M., to 34 at 4.30 P.M. At 7.30 the next morning he was breathing feebly. Cat 1 died at 8 A.M.

Experiment 3. Summary. Two cats were each given 20 c.c. of 40 per cent. alcohol per kilo body-weight intraperitoneally in two equal doses, twenty-four hours apart. One died twenty-six and three-quarter hours after the first injection. The survivor had received 0.15 mg. of strychnine sulphate per kilo body-weight in six doses.

Protocol. Two healthy cats were taken, Cat 1 weighing 2700 gm.,

Cat 2, 2610 gm.

9 A.M., Cat 1, pulse 140, respiration 36; Cat 2, pulse 140, respiration 42. First injection: Cat 1 and Cat 2 receive 10 c.c. of 40 per cent. alcohol per kilo weight intraperitoneally; Cat 2 gets 0.025 mg. of strychnine sulphate solution 1:20,000 subcutaneously. Four minntes after injection both are lying on the side. Twelve minutes after injection, Cat 1, pulse 140, respiration 78; Cat 2, pulse 140, respiration 78. Forty-five minutes after injection, Cat 1, pulse 140, respiration 92; Cat 2, pulse 140, respiration 120. One hour after injection Cat 2 is given another dose of strychnine of the same size. Both make movements occasionally. One and one-half hours after first injection, Cat 1, pulse 140, respiration 64; Cat 2, pulse 140, respiration 80; both are sleepy. Two and one-quarter hours after injection, gave the third dose of strychnine to Cat 2. Two and one-half hours after first injection both appear exactly as if merely asleep. Cat 1, pulse 140, respiration 64; Cat 2, pulse 140, respiration 56. Five hours after injection both asleep. Cat 1, pulse 140, respiration 46; Cat 2, pulse

140, respiration 36. Fifteen minutes later another dose of strychnine to Cat 2. Five and three-quarter hours after first injection Cat 1 moves about, using the front legs, the hind legs still being useless. Cat 1, respiration 44; Cat 2, respiration 40. Six and one-half hours after injection another dose of strychnine to Cat 2. Forty-five minutes later, Cat 1, pulse 120, respiration 40; Cat 2, pulse 120, respiration 28. Cat 1 is more conscious and more desirous of moving about than Cat 2. The next morning both were alive and conscious. Cat 2 seems to be more vigorous than Cat 1, for he will walk about.

9 A.M., Cat 1, pulse 140, respiration 28; Cat 2, pulse 140, respiration 36. Second injection the same as the first. Twenty minutes later both lie quiet. Cat 1, pulse 140, respiration 28; Cat 2, pulse 140, respiration 80. One hour after injection, Cat 1, pulse 142, respiration 42; Cat 2, pulse 140, respiration 44; Cat 2 more conscious than Cat 1. Two and one-quarter hours after injection Cat 1 begins to gasp. Five minutes later Cat 1 dies; Cat 2 is asleep, pulse 140, respiration 28. Allowed Cat 2 to live one and one-quarter hours longer; pulse and respiration remained unchanged; made voluntary movements and

reacted to pain.

Experiment 4. Summary. The effect of strychnine in counteracting alcohol when given in smaller doses during a longer period was tested in this experiment. Two kittens were each given 35 c.c. of 20 per cent. alcohol and 105 c.c. of 40 per cent. alcohol per kilo body-weight during thirteen days, and one of them received 3.1 mg. of strychnine sulphate per kilo weight in 1:5000 solution in addition to alcohol. Neither cat died. The cat that received strychnine showed a somewhat greater paralytic effect at the end of the experiment.

Protocol. Two healthy and lively kittens were taken, Cat 1 weigh-

ing 930 gm., Cat, 2 910 gm.

First day, 12.45 P.M., subcutaneous injection of 0.1 mg. per kilo weight of strychnine sulphate into Cat 2. Twenty-five minutes later noticed increased reflex excitability, for Cat 2 would start up as if struck at every sudden sound.

2 P.M., injected 5 c.c. of 20 per cent. alcohol per kilo weight subcutaneously into Cat 1 and Cat 2. Twenty-five minutes after injection both are lying down, sleeping lightly. Cat 1, respiration 28; Cat 2,

respiration 19; Cat 2 still excitable.

3 p.m., another injection of alcohol, same as before, and a second dose of strychnine to Cat 2. Excitability of Cat 2 has decreased. Thirty minutes after injection excitability of Cat 2 is again increased; both asleep; respiration of Cat 1 is 30, of Cat 2, 23.

4 P.M., neither seem to be under the influence of the alcohol.

Second day, 9 A.M., both are normal; eat and drink heartily. Cat

2 shows no increased reflex excitability.

9.30 A.M., injection of 5 c.c. of 20 per cent. alcohol per kilo weight subcutaneously into Cat 1 and Cat 2, and of 0.1 mg. of strychnine sulphate per kilo weight into Cat 2. Thirty minutes later neither show any alcohol effect. Cat 2 begins to manifest increase of excitability; respiration of each is 36 to 40.

10 A.M., second injection same as first. Thirty minutes later both are

less lively, Cat 2 more restless than Cat 1.

11 A.M., third injection, same as before. Fifteen minutes later both are sleepy. Twenty-five minutes after the injection neither cares to

move about; respiration of each 40 to 48. When roused up Cat 1 shows weakness of the hind legs; Cat 2 does not. Four hours after injection both have almost recovered.

3.30 P.M., fourth injection, same as before. One hour after injection both are sleepy, but can walk naturally when aroused; Cat 2 still shows

increase of excitability.

Third day, 8.30 A.M., both seem normal; eat and drink freely.

8.40 A.M., first injection, same as on the day before. Thirty minutes later no effect noticeable.

9.20 A.M., second injection, 5 c.c. of 40 per cent. alcohol per kilo weight, subcutaneously into Cat 1 and Cat 2 and 0.1 mg. of strychnine sulphate per kilo weight into Cat 2. Forty minutes later both are

asleep.

10.40 A.M., third injection, same as second. Cat 2 becomes very restless within a few minutes. Thirty minutes after injection both lie quietly; Cat 2 is more excitable than he has been. Forty-five minutes after injection both are disposed to lie still, but can walk with a wobbling gait when aroused. Three and one-half hours after injection both are sleepy; respiration 34 to 36; both show partial paralysis of the hind legs, tending to stagger and fall over onto the hip in walking. Thirty minutes later an extra dose of strychnine to Cat 2.

4 P.M., both are asleep; can walk better: Cat 2 is slightly excitable.

Fourth and fifth days: No drugs were administered.

Sixth day: Kittens are normal.

9.40 A.M., injection of 0.1 mg. of strychnine sulphate per kilo weight into Cat 2.

10.12 A.M., injection of 5 c.c. of 40 per cent. alcohol per kilo weight into Cat 1 and Cat 2.

10.55 A.M., second injection of alcohol and strychnine in the same doses as before. Twenty minutes later both are lying down. Four and one-half hours after injection Cat 1 seems to be sleepier than Cat 2; Cat 2 is less excitable than usual.

3.30 P.M., injection of an extra dose of strychnine into Cat 2.

Twenty minutes later Cat 2 shows increased excitability.

4 P.M., third injection, same as second. Fifteen minutes later both stagger when they walk.

Seventh day: No drugs given. Eighth day: Both seem normal;

have good appetite.

2.15 P.M., injection of 10 c.c. of 40 per cent. alcohol per kilo weight into Cat 1 and Cat 2, and of 0.2 mg. of strychnine sulphate per kilo weight into Cat 2. Twenty minutes later both are sleepy; Cat 2 is not excitable.

3.30 P.M., second injection, 5 c.c. of 40 per cent. alcohol per kilo weight, into Cat 1 and Cat 2; 0.2 mg. of strychnine sulphate per kilo weight into Cat 2. Thirty minutes later both are lying quietly; both stagger when made to walk; Cat 2 walks steadier than Cat 1.

Ninth day: Neither is lively; can walk, but is indisposed to. Cat

2 seems sicker than Cat 1.

9 A.M., injection of 10 c.c. of 40 per cent. alcohol per kilo weight, subcutaneously into Cat 1 and Cat 2, and of 0.2 mg. of strychnine sulphate per kilo weight into Cat 2. Twenty-five minutes later both are lying down asleep. Two and one-quarter hours after injection both can walk about; neither would eat much meat.

11.15 A.M., second injection, 5 c.c. of 40 per cent. alcohol per kilo weight, into Cat 1 and Cat 2; 0.1 mg. of strychnine sulphate into Cat 2. Three and one-quarter hours later neither can walk well; Cat 1 is steudier than Cat 2; Cat 2 is very sleepy and shows no increase of reflex excitability.

3.20 P.M., extra dose of strychnine to Cat 2. Twenty minutes later

Cat 2 shows slight excitability.

4.35 P.M., third injection, same as second.

Tenth day: Cat 2 is more indisposed than Cat 1. They have eaten

the meat left in the cage the evening before.

9.20 A.M., injection of 10 c.c. of 40 per cent. alcohol per kilo weight into Cat 1 and Cat 2, and of 0.2 mg. of strychnine sulphate per kilo weight into Cat 2. Reweighed them: Cat 1 weighs 1060 gm., Cat 2 960 gm., Cat 1 having gained 130 gm. and Cat 2, 50 gm. in eight days. One and one-half hours later Cat 2 is more profoundly asleep than Cat 1; respiration of Cat 1 is 36, of Cat 2, 22.

3 P.M., second injection, 5 c.c. of 40 per cent. alcohol per kilo weight, into Cat 1 and Cat 2; 0.1 mg. of strychnine sulphate per kilo weight into Cat 2. Twenty minutes later Cat 1 walks unsteadily; Cat 2 can-

not walk.

Eleventh day: No drugs given. Twelfth day: Both seem to have

recovered; Cat 1 is livelier than Cat 2.

11.25 A.M., injection of 10 c.c. of 40 per cent. alcohol per kilo weight into Cat 1 and Cat 2, and of 0.2 mg. of strychnine sulphate per kilo weight into Cat 2. Two and one-half hours after injection they have recovered partially from the alcohol.

2.15 P.M., second injection, 5 c.c. of 40 per cent. alcohol per kilo weight, into Cat 1 and Cat 2; 0.1 mg. of strychnine sulphate into Cat 2. One hour later Cat 2 is soundest asleep and weakest when it trics

to walk

3.30 P.M., third injection, 10 c.c. of 40 per cent. alcohol per kilo weight, into Cat 1 and Cat 2; 0.1 mg. of strychnine sulphate into Cat 2. Forty minutes later both show the most marked paralytic effect yet obtained. Cat 1 can only crawl a little when aroused; Cat 2 lies perfectly relaxed and cannot be made to move.

Thirteenth day: 9.30 A.M., both cats are still narcotized. Cat 2 is still paralyzed, more than Cat 1. Respiration of Cat 1 is 19, of Cat 2 12. Weight of Cat 1 is 1060 gm., of Cat 2 is 910 gm., Cat 1 being of

the same weight as on the ninth day, Cat 2 being 50 gm. lighter.

10.30 A.M., intraperitoneal injection of 5 c.c. of 40 per cent. alcohol per kilo weight into Cat 1 and Cat 2; 0.1 mg. of strychnine sulphate per kilo weight into Cat 2. Neither gave evidence of pain from this injection.

3.15 P.M., Cat 1, pulse 130, respiration 28; Cat 2, pulse 130, respira-

tion 20. Both are almost comatose.

3.30 P.M., killed both kittens.

III. Does Acute and Subacute Alcohol Poisoning Lead to Histological Changes in Nerve Cells?

Method of Investigation. Pieces of the spinal cord, cerebellum, and cerebrum from corresponding locations were removed from guinea-

pigs A and B of Experiment 1, and also from a normal guinea-pig. They were then fixed and hardened in absolute alcohol; sections were cut without embedding, and stained by Nissl's method on the same slides, as directed by C. C. Stewart.¹

The same course was pursued with Cat 1 of Experiment 2 and Cats 1 and 2 of Experiment 3; also a normal cat. The tissues taken from the two kittens of Experiment 4 were fixed in 10 per cent. formalin, then put through graded alcohols and embedded in celloidin. The sections were stained with erythrosin, then with Nissl's methylene blue, as directed by F. R. Bailey.²

Results. The nerve cells of normal and drugged animals were not distinguishable the one from the other; all stained beautifully and showed no injury to nucleus or nucleolus. In all the sections the Nissl bodies or granulations of the large nerve cells were distinct and numerous. Only in extra thin portions of the sections were these granulations less numerous. No constant difference was observable between nerve cells from the normal and from the poisoned animals. It was, therefore, impossible to corroborate the results reported by C. C. Stewart.

IV. THE INFLUENCE OF CERTAIN DRUGS UPON THE QUANTITY OF GAS FORMED BY YEAST.

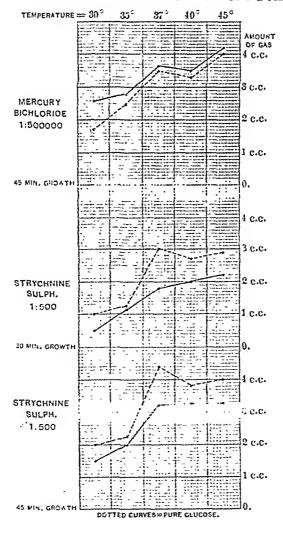
Method of Experimentation. Fermentation tubes were used, the amount of gas formed from a given amount of glucose solution by the action of yeast within a given time being estimated. The ordinary method was found to be too unreliable, and it was modified as follows: The upright limb of the fermentation tube was filled about half-full with mercury, then, while the tube was still held inverted, a measured quantity (usually 2 c.c.) of a 5 per cent. solution of pure glucose in distilled water was run in on top of the mercury by means of a pipette, and was followed by an equal quantity of yeast mixture (usually 10 per cent. of compressed yeast suspended in distilled water), then the tube was immediately placed upright and all of the glucose-yeast mixture drawn up above the mercury by tilting the tube slightly so that it was sucked up out of the neck by capillarity. The tubes were kept in an oven at 35° to 40° C. during the period of gas formation. Drugs were dissolved in the glucose solution before the latter was put into the tubes. Each drugged tube was accompanied by an undrugged tube as a control, which was filled at the same time and contained the same amount of glucose and yeast as its fellow. The reading of the amount of gas formed in the two tubes was made before the mcrcury

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Table I.—Effect of Drugs on Gas Formation by Yeast in 2½ per cent. Glucose at 40° C.

COHCENTRATION OF THE DRUG=1: 0 -50000-20000-10000-10000-2000-1600-1200-800-500-400-333-250-200-133-100-80

TABLE II .- EFFECT OF TEMPERATURE ON GAS FORMATION.



had all been forced out of the upright tube. By this means no gas escaped into the air, and the yeast cells were cut off from atmospheric influences.

Results. These are given in the accompanying diagram (Table I.). The strength of the solution of the drug in the glucose-yeast mixture is indicated at the top of the columns. Increase of gas formation is indicated by rise of the action curve above the horizontal line, decrease of gas formation by depression below the line. It will be seen that no reliable stimulant was discovered. Alcohol gave curious results, sometimes having no effect, twice increasing gas formation, but generally decreasing it. The apparent stimulation in two cases may possibly have been due to some error in manipulation. Bichloride of mercury, 1:500,000, which is said to have a decided stimulant action on yeast, had but slight action at temperatures above 30° C.

The effect of different temperatures was ascertained in another series of experiments. A temperature intermediate between 35° and 40° C. proved to be the optimum temperature (see dotted curves, Table II.) for fermentation in undrugged tubes. The action of the drugs given in Table I. was the same in quality at 30° C, as at 35° to 40° C, except that bichloride of mercury showed marked stimulant action at 30° C, and very little at higher temperatures. (See Table II.)

All of these drugs were such as either have been reported to stimulate yeast activity or were considered as promising because of known stimulant action on cells of the animal organism.

V. THE ANTAGONISM OF HEAT AND STRYCHNINE ON YEAST.

The search for a reliable stimulant proving fruitless, a study was made of the effect of heat as a physical stimulant, and of the antagonistic action of strychnine in preventing the stimulation by elevation of temperature.

The results of two series of experiments are shown in Table III. It will be noticed that the average percentage of gas production under the influence of strychnine in the two series at 35°, 40°, and 45° C. range from 75 per cent. to 81 per cent. of the glucose for the thirty-minute period of growth, and from 79 per cent. to 86 per cent. for the forty-five-minute period, indicating practically the same degree of strychnine action for all three temperatures.

At 30° and 37° C., however, the depressing action of the strychnine is very much more pronounced for both periods of growth than at any other temperatures (58 to 73 per cent.); therefore we cannot be dealing with a case of pure antagonism, for if the effects of strychnine and heat were strictly antidotal the counteraction should be quantitatively the same at successive temperatures, or should, at least, vary in a constant

direction, as it does in the case of time. Table IV. illustrates this point, namely, that the increased amount of gas formed in the forty-five-minute periods as compared with that formed in the corresponding thirty-minute periods would make a fairly smooth curve for both strychnine and glucose.

		•		
TABLE	III EFFECT	OF TEMPERATURE	ON GAR	FORMATION

	Temperature, amount and percentage of gas.											
	3	ევ	350		350-370		400		450			
	C.c.	0/0	C.c.	! o/o	C.c.	0/0	C.c.	0/0	C.e.	0,0		
Pure glueose	1, 2	100	1.4	100	2.0	100	2.2	100	2.7	100	1st	series,
30 miu. growth	0,6	100	1.4	100	3.0	100	2.5	100	2.9	100	2d	**
Strychnine 1 : 500	0,7	58	1.1	78	1.3	65	1.6	72	2.0	74	1st	4.5
30 min. growth	0, 4	66	1.2	85	1.9	63	2.0	80	2.2	76	2d	**
Pure glucose	2.1	100	2.3	100	4.0	100	3.4	100	4.0	100	1st s	eries.
45 min. growth	1.4	100	2.7	100	4.5	100	4.0	100	4.0	100	2d	"
Strychnine 1 : 500	1.3	61	2.0	87	2.35	59	3.0	88	3.1	77	lst	**
45 min. growth ;	1.0	71	2. 2	81	3.3	73	3.4	85	3.3	82	2d	**

TABLE IV.—EFFECT OF TIME ON GAS FORMATION.

	Temperature, amount and percentage of increase.										
	1 3	ეი	350		350_370		400		450		
	C.c.	0/0	C.c.	0,'0	C.e.	0/0	C.c.	0/0	C.c.	0/0	
Pure glueose	0.9	76	0.9	57	2.0	, 100	1.2	54	1.3	48	1st series.
	. 0.8	133	1.3	92	1.5	50	1.5	60	1. I	38	2d "
Average	0.85	105	1.05	75	1.75	75	1.35	57	1.2	43	
Strychnine	0.6	84	0.9	81	1.0	80	1.4	87	1.1	55	1st series.
1:500	0. 6	150	1.0	83	1.4	73	1.4	70	1.1	50	2d "
Average	0.6	117	0.95	82	1.2	77	1.4	78	1.1	53	

In regard to the effect of time, it is to be noted that the increase in the absolute quantity of gas is much more constant in the two series of experiments than is the increase of the percentage of gas.

VI. CONCLUSIONS.

- 1. Strychnine does not seem to affect the pulse when given simultaneously with alcohol.
- 2. In some cases (Experiments 1 and 3) strychnine seems to counteract in part the depressing effect of acute alcoholic poisoning on the respiration, and thus prolong life. The apparent exception (Experiment 2) is doubtless explained by the poor physical condition of the cat receiving strychnine and by the small dose.
- 3. Strychnine does not seem to interfere materially with the narcosis from acute poisoning with alcohol, but, apparently, does delay the onset of paralytic symptoms.
- 4. In subacute alcoholic poisoning (Experiment 4) strychnine seems to lessen the narcosis and paresis in the earliest stages, but in the later stages to increase the depression. However, a general conclusion is hardly justified, since only one control experiment was made.
- 5. Although in no case was the strychnine competent to completely remove the effects of the large doses of alcohol which were employed, yet it may be considered probable that appropriate doses of strychnine (fairly strong therapeutic doses) would prove useful in the treatment of poisoning from even lethal doses of alcohol.
- 6. No action on the nerve cells by either alcohol or strychnine was demonstrable histologically.
- 7. Many drugs depress the activity of yeast cells, but no reliable stimulant was found; therefore the antagonism of drugs in their action on these cells could not be studied.
- 8. Heat was found to be a reliable stimulant up to 45° C., but strychnine as an antidote to heat did not give uniform results at the successive temperatures, so that the antagonism is not a simple one.

BLOOD CHANGES IN DEMENTIA PARALYTICA.

BY A. R. DIEFENDORF, M.D., LECTURER IN PSYCHIATRY, YALE UNIVERSITY MEDICAL SCHOOL.

(From the Laboratory of the Connecticut Hospital for the Insane.)

The blood of patients suffering from dementia paralytica has been the subject of microscopic study by many observers during the past fifty years, but none have made regular and systematic examinations extending over a considerable portion of the course of the disease. Believing that such a study, so conducted as to eliminate all known physiological changes, might throw further light upon the nature of this important disease, this work was begun at the suggestion of Dr. August Hoch in the spring of 1901. The present is a preliminary report upon eleven cases

HISTORICAL. The earliest known studies of the blood of paretics were made by Erlenmeyer and Hittorf in 1846 and 1847; Michale, 1848; Sutherland, 1873, and Voisin, 1879; but as their studies were made with instruments which would not give results comparable with our own, they are not taken into consideration.

Macphail, in his study of fifteen cases of paresis, in which he laid special stress upon the blood state in different stages of the disease, ascertained that the hæmoglobin and erythrocytes were relatively low in the first stage, increased slightly during the quiescent period, and diminished greatly during the final stage, but showing, as a whole, a qualitative and quantitative diminution which runs parallel to the progress of the disease; also, that the leukocytes increased proportionately toward the end of the disease, and, finally, that states of excitement seemed to have an especially great influence upon the condition of the blood.

Thompson, as quoted by Macphail, in the examination of five typical cases of paresis in the stage of onset, the demented and the paralytic stages, found that within the first six months the hæmoglobin averaged 66.2 per cent., and the proportion of the white and red cells to be 1:308; six to fifteen months, hæmoglobin, 70 per cent., and whites and reds 1:176; and toward the end of the disease hæmoglobin 60.6 per cent., and proportion of whites and reds to 1:124.

The conclusions of Lewis, cited by Capps, were similar to those of Thompson.

Smyth,² in the study of forty cases of paresis in which the duration of the disease varied from the second to the thirty-third month, discovered that there was a diminution of hæmoglobin, except during periods of great exaltation, and a marked falling off in the number of red cells.

Winkler,³ in four cases of paresis, three of whom were moderately nourished and one well nourished, found the hæmoglobin diminished as well as the number of red blood corpuscles. In one case they were high. They always diminished as the disease approached its termination. The changes of the blood were parallel with the loss of weight. In the stages of excitement the hæmoglobin and red blood corpuscles, both diminished at the onset, remained stationary in the period of quiescence and fell rapidly in the last stage. The body-weight presented a similar change, *i. e.*, in the stage of quiescence it remained the same or increased slightly, and in the end stages fell rapidly.

¹ Journal of Mental Science, 1884, p. 878. ² Ibid., 1890, p. 501.

³ Ueber Blutuntersuchungen bei Geisteskranken, Inaug. Dissert., Bonn, 1891, pp. 5-39.

Paralytic attacks had a bad effect upon the blood and produced a loss of weight.

Kryspiakiewicz¹ examined fifteen cases of paresis, mostly progressive cases and some during the terminal state and when suffering from acute decubitus. While his observations in general agree with those of Smyth, he also frequently found poikilocytosis, and a larger number of megalocytes and a smaller number of microcytes than is normally present.

Roncoroni,² in his study of fifteen paretics, in which he paid special attention to the eosinophiles, found that they were sometimes increased, sometimes diminished, but rarely normal, and that in paretic excitement there was regularly an increase, which in one case reached 25 per cent.

Burton, as cited by Somers, found in four cases of paresis a diminution of the leucocytes and of the hæmoglobin.

Somers,³ in the examination of five cases of paresis, discovered a falling off of the erythrocytes and a slight increase of the leucocytes (8800), and a decline of the hæmoglobin (74.2).

Capps⁴ in nineteen paretics found a more or less striking diminution of hæmoglobin (70 to 90 per cent.), but a steady increase was noted, dating from the admission to the hospital, which, by the author, was believed to be due to the improved hygiene and nutrition. In only four cases did the erythrocytes reach 5,000,000. There was present in the majority of cases a moderate leukocytosis, yet no conclusion could be drawn as to the relationship between the different stages of the disease and the degree of leukocytosis. He, however, failed to find a leukocytosis in two cases examined within four months of the onset, while one case of the same duration, but of rapid progress, did exhibit leukocytosis. In studying the variety of leukocytes, he found that the small lymphocytes were less numerous than normally, and the large lymphocytes were slightly increased, but sometimes three times the normal amount. The polymorphonuclear variety was slightly increased in fourteen of the nineteen cases, but in only one instance above 78.8 per cent.

Of rather more importance was his observations in reference to the blood changes at the time of a paralytic attack. Shortly preceding paralytic attacks, there was an increase of the erythrocytes and hemoglobin, and shortly following them a very transitory but pronounced leukocytosis. The erythrocytes and hemoglobin fell a few hours later. The intensity of the leukocytosis depended upon the severity and the duration of the attack.

¹ Wien. med. Wochenschrift, 1892, No. 25.

² Archiv di Psichiat. Scienze, 1894, vol. xv., fasc. 111, p. 293.

³ New York State Hospital Bulletins, January, 1896.

⁴ THE AMERICAN JOURNAL OF THE MEDICAL SCIENCES, 1897.

Jeliffe, in his observations, which consisted of one examination in each of seventeen cases, ascertained that the hamoglobin was reduced in nearly all cases, that the erythrocytes were comparatively high, the number being increased in fourteen of the seventeen cases, and in eight of these amounting to more than 6,000,000. The leukocytes were reduced in seven cases, and in only three cases was a leukocytosis recorded, and accompanied in each case a "general exalted condition." His observations on the differential count, in general, accords with those of Capps, except that the author calls attention to the complete absence of eosinophiles in some cases.

Case I.—The patient developed his psychosis at the age of forty years. He was known to have been intemperate. The character of the disease, during the first twelve months, was one of simple progressive dementia, which did not necessitate confinement. He then, rather suddenly, exhibited great motor restlessness with violence, expressed many expansive delusions of a religious nature and some hallucinations, and consciousness became greatly clouded. He was admitted to the hospital two weeks later. The condition of paretic excitement continued without abatement for about one month, when it gradually disappeared, leaving the patient in a condition of profound dementia, with greatly impaired memory, clouded consciousness, paralysis of thought and volition, and emotional indifference. Extremely expansive and Nihilistic delusions were alternately expressed, while his conduct was characterized by occasional outbreaks of irritability and violence, but otherwise he was orderly. Physically, he presented fine muscular tremor, considerable inco-ordination, faulty articulation, exaggerated deep reflexes, and unequal pupils, which responded to light within narrow limits.

The patient was in this condition at the time the blood examinations were begun, and continued without appreciable change until the twenty-fourth month, when he gradually became noisy and extremely filthy, but did not show any other evidence of increased psychomotor activity. Meanwhile, he had improved greatly in nutrition. In the twenty-sixth month, following a rather rapid fall in nutrition, he suddenly developed an apoplectic attack, with left hemiplegia, from which he recovered in five days. He then, for the first time, expressed delusions of poisoning, and persistently refused food, with consequent rapid emaciation, and death twenty-two days later, preceded by somnolence and, finally, stupor. The paralytic attack was followed in twenty-four hours by a high temperature (104° F.) which subsided on the third day, but from that time until death there was a pretty constant daily variation of temperature, extending from 96.6° F. to 100° F. There was no evidence of an acute inflammatory process which might account for a leukocytosis. The weight fell rapidly during the final fourteen weeks, dropping from 157 to 85 pounds.

A post mortem examination was not made.

The study of the blood in this case, which comprised sixty-one weekly examinations, began just after the subsidence of the paretic excitement. During the first month both the hæmoglobiu, the ery-

¹ New York State Hospital Bulletins, July, 1897.

throcytes, and leukocytes averaged below normal, but following this and during the entire quiescent period, except for four weeks preceding the paralytic attack, and when the nutrition was beginning to fall, the hæmoglobin averaged 85 per cent., thence the hæmoglobin fell to an average of 74 per cent., until it began to rise nine days before death, and two days before death reached 92 per cent.

The erythrocytes rose to normal and remained within normal limits until the fall in nutrition, when they fell to below normal, and remained there until the nine days previous to the paralytic attack, when they rose to normal and gradually increased until they reached 6,386,000

two days before death.

The leukocytes following the first four weeks remained high normal for two and one-half months, when they fell to low normal and at times below 5000, where they remained for ten weeks; then high normal for four weeks, followed for sixteen weeks by a count varying between 8600 and 6000, with one exception, when for a week they rose to 9500. Then, one week previous to the fall of nutrition, when both the percentage of hæmoglobin and number of erythrocytes diminished, the leukocytes fell to 5000 and remained subnormal, with one exception (6800), until the terminal rise which began sixteen days before the paralytic attack, but did not become a distinct leukocytosis until the ninth day following it. The leukocytosis reached its height seven days previous to death, and fell on the last count to 13,5000. Among the leukocytes the polymorphonuclear variety predominated throughout, the percentage of which varied from 5 to 26 per cent. above the normal; upon only one occasion did it approach normal, and then it was 71.8 per cent. The greatest increase appeared during the final leukocytosis, when the percentage remained above 92 per cent. during the last four

CASE II.—This patient gave the first evidence of his disease at the age of forty-two years. It was of gradual onset, with a loss of interest in his work and a lack of endurance. At times he was also forgetful. He, however, continued at work for seven months, at which time he rather suddenly developed many changeable delusions of grandeur, with a feeling of well-being and an increased activity. One month later, when admitted to the hospital, he showed a defect of memory for both recent and remote events, a pronounced feeling of well-being, some pressure of activity, together with the most extremely expansive delusions, insomnia, anorexia, and loss of weight. Physically, there were contracted pupils which were irresponsive to light, general muscular tremor, faulty articulation, some ataxia of the lower extremities, absence of knee-jerks, and a lack of muscular tone. In the ninth month he developed a condition of paretic excitement during which the first examination of the blood was made. After a duration of two months this condition suddenly disappeared, leaving the patient in a condition of deeper dementia. He continued mildly elated but orderly After an intermission of five weeks the condition of great excitement returned and continued for one month, when it again van-He lost sixteen pounds in weight, and at the end showed great muscular weakness. At this time the feeling of well-being was replaced by one of despondency and fear of death, and all delusions vanished. While he was quite orderly in conduct, took some interest in his surroundings, aided in ward duties, and spent much time in reading, he

had lost all power of endurance, and usually became so fatigued by afternoon that it was necessary for him to go to bed; at the same time speech became confused. The condition of muscular paresis gradually progressed, and terminated fatally in an attack of syncope four months later, the total duration of the disease being nineteen months.

The temperature during the last four months occasionally dropped to 96° F., and even 95° F., and rose to 100° F., and on a few occasions to 102° F. and 103° F. without any apparent cause. During the two weeks preceding the paralytic attack it was mostly subnormal. Ten days before death it rose to 100.6° F.; thence there was a daily rise and fall, varying between 100.8° F. and 97° F., reaching 101.8° F. on the day of death. There were no objective signs of an acute inflammation process. The weight fell gradually from the eleventh month, when it was 139 pounds, to 79 pounds at the time of death. An

autopsy was refused in this case.

The blood analysis began during the height of his first paretic excite-The first two examinations, which were made at an interval of twenty six days, showed the hæmoglobin to have risen from 73 to 100 per cent., and the leukocytes from 6500 to 10,300, while the erythro-The remaining counts were made cytes remained at low normal. bi-weekly until the last two months, when they were made weekly. In the remission of five weeks the hæmoglobin remained between 77 and 83 per cent., the erythrocytes rose from low to high normal, while the leukocytes went up to 14,000 and then fell to 7800. In the period of excitement which followed this for two months, but which was not as intense, though it led to great physical weakness and the loss of nearly sixteen pounds in weight, the hæmoglobin varied between 76 and 102 per cent.; the erythrocytes remained normal and high normal, and rose at one time to 5,800,000, and there was a leukocytosis, except for one week, when the leukocytes fell to 8700. During the quiescent period of four months which followed the hæmoglobin varied from 62 to 89 per cent., but averaged 76 per cent.; the erythrocytes remained normal and high normal, except on two occasions, when they fell to 4,000,000, and 4,500,000; the leukocytes varied considerably, twice falling to nearly 6000 and once below, and three times showing a moderate leukocytosis; otherwise they were about normal. ination of the blood on the day of the collapse showed the hæmoglobin at 67 per cent., the erythrocytes at 4,888,000, and the leukocytes at 8400. Six days later, while the patient continued to fail and at the time was in a semicomatose condition, the hæmoglobin rose to 82 per cent., the erythrocytes to 5,982,000, and the leukocytes to 16,000. Death occurred sixty hours later.

The differential count showed, throughout the whole psychosis, a great increase in the percentage of polymorphonuclear leukocytes, which

reached at the last two counts 90 and 86.4 per cent.

CASE III.—This case is not cited in full because of the limited study of the blood, which comprised two examinations, on the twelfth and

seventh days before death.

The patient first gave evidence of the psychosis at fifty-four years of age. There was some insane collateral heredity, but otherwise no etiological factors could be ascertained. The disease was of gradual onset, and the symptoms were those characteristic of the demented form until one week previous to his commitment in the twelfth month, when

he rapidly developed symptoms characteristic of the agitated form of the disease. This condition of intense excitement continued until he fell into a semicomatose state seven days before death, which gradually deepened, being accompanied by a dysenteric condition. physical signs of the disease were well advanced at the time of his The patient was much emaciated, which condition rapidly increased until death. There was no autopsy in this case.

In the two blood examinations the percentage of hemoglobin was at first 90 per cent., but then fell to 65 per cent. The erythrocytes were normal, and then fell below normal; the leukocytes showed a leukocytosis (10,000), which advanced to 14,100, in which there was an increased percentage of polymorphonuclear leukocytes (84 and 86 per

CASE IV .- The exact date of the onset of the psychosis and the character of its early symptoms are unknown. At the time of her admission she was thirty-four years of age, and the disease had already reached the stage of profound dementia, with complete clouding of consciousness, greatly impaired memory, emotional deterioration and a considerable emotional irritability, pronounced limitation in the store of ideas, considerable incoherence, some increased psychomotor activity, and complete inability to care for herself. Physically she presented Argyll-Robertson pupils; great ataxia, which necessitated confinement in bed; faulty speech, pronounced tremor of hand and of facial muscles, exaggeration of deep reflexes, and considerable emaciation. Two months previous to her commitment she had a series of epileptiform attacks.

At the time of the first blood examination, which was made thirteen days after admission, the patient was still showing some psychomotor activity, confined mostly to a purposeless fumbling with her clothing, sometimes tearing or removing it, and incessant talking in a loud voice, but this gradually disappeared by the end of the first month of her

At this time there suddenly developed a paralysis of the left arm, unaccompanied by other phenomena. From this time the activity began to diminish. In the fourth month her mind had become a complete blank, acute decubitus appeared, and the terminal phalanges of the paralyzed left hand sloughed off. From this time paresis of all the muscles became more marked, acute decubitus advanced, and she died three months later, at no time showing a rise of temperature. weight could not be taken in this case. Post-mortem examination

corroborated the diagnosis.

The examinations of the blood were made bi-monthly in this case, and show, in reference to the percentage of hæmoglobin, that it averaged low, especially during the last month of the disease (68 per cent.). Previous to this it reached 90 per cent. only on two occasions. estimation of the erythrocytes showed a normal and high normal count, except for the first and next to the last examinations, when it fell to During the second and third months previous to death it varied between 5,150,000 and 5,666,000, but during the terminal month it fell below 5,000,000, was lowest thirteen days before death, and then rose to about 4,700,000 four hours previous to her death. The leukocytes remained below normal during the first three months, except on two occasions, when there was a very moderate leukocytosis

(9733 and 10.666). Thence for one and one-half months it was high normal, and thence for one week there appeared a leukocytosis of 14.000. It then dropped to normal and low normal, except on the twenty-seventh day before death and four hours before death, when it reached 10.100 in the former and 14.600 in the latter. In the differential count the polymorphonuclear leukocytes were constantly above

normal, and in the final leukocytosis reached 94.2 per cent.

CASE V .- This patient developed his psychosis at the age of thirtyfive years. It was of gradual onset and characterized by a progressive deterioration in memory and judgment. Within a month he began to express numerous grandiose delusions, and showed considerable increase Two weeks previous to his admission to the hospital, in the twelfth month of the disease, he suffered from a series of epilentiform convulsions, followed by transitory paresis in the left arm and mentally by great clouding of consciousness and extreme activity, simulating the occupation delirium of senile dementia. This condition still persisted at the time of his admission. He was emaciated insomnia was marked, the deep reflexes were abolished, the pupils did not react

to light, and ataxia was marked. Dementia was profound.

At the time of the first blood examination, in the fourteenth month of the disease, the restlessness had somewhat subsided, but deterioration had advanced and emaciation had become still more prominent. He was, however, very loquacious. In the fifteenth month the activity began gradually to increase, and the patient became destructive, filthy, and very noisy. By the third week the excitement had become extreme, and continued so for one week, when the patient developed epileptiform attacks, which assumed the form of an epileptic status and lasted for twenty-four hours, followed by a semicomatose state, which terminated fatally eight days later. During his five months' residence in the hospital the patient gradually fell in weight from 123 pounds to about 85 pounds. The temperature was not taken during his final illness, but apparently was normal. An autopsy revealed the character-

istic lesions of paresis.

In studying the condition of the blood, which was examined weekly until the final ten days, when four counts were made, we find that the hæmoglobin did not show any great variation. During the period in which the motor excitement had subsided, it rose to 90 per cent. on three occasions, but from that time on it remained pretty constantly about 85 per cent., with one exception, which was the day following the epileptic status, and then it fell to 76 per cent. The erythrocytes remained about normal until the final excitement, when they gradually rose until the day following the convulsions, then fell to normal, but four days later, which was three days previous to death, they had reached 6,333,000. The leukocytes remained below normal until the appearance of the great excitement preceding the convulsions, when a leukocytosis appeared. This reached 17,200 the day following the convulsion, but had dropped to 14,200 three days before death. among the different forms of leukocytes present that the polymorphonuclear variety was always above 79 per cent., and during the terminal leukocytosis reached 93.4 per cent.

CASE VI.—The patient developed her psychosis at the age of fortyone years. The onset was gradual and characterized by despondency, delusions of self-accusation and fear, but further than this the nature of her psychosis was unknown until her admission to the hospital one year later. At this time she was profoundly despondent, showing great apprehension and expressing fear of death. She was greatly agitated and lamented loudly. In fact, the clinical picture was that of the so-called "agitated melancholia." Physically she presented marked emaciation, anorexia, and constipation, but none of the characteristic physical symptoms of dementia paralytica. In the fifteenth month of the disease she began to improve rapidly, and in the course of one and one-half months had apparently recovered, in this time having gained ten pounds in weight.

During the succeeding twenty-five months the patient seemed quite normal, except that she exhibited a greater tendency to indulge in

alcoholic excesses.

The disease gradually reappeared at the age of forty-three years. She began to neglect her household duties and her own personal appearance, would serve her meals uncooked, stole money from her husband and spent it for liquor, attempted to travel away from home without money, and at times was threatening. Upon admission to the hospital three months from the onset it was found that she had already greatly deteriorated, especially in memory and judgment. Many absurd and extremely grandiose delusions were expressed. There was marked emotional deterioration, while her volitional condition exhibited stupor, relieved at times by some pressure of activity, volubility, and a feeling of well-being, with impulsive violence. Physically she presented an absence of tendon reflexes, pupils that were unequal and refused to react to light, faulty articulation, considerable muscular tremor, some ataxia, and general lack of muscular tone. In the fifth and sixth months dementia had gradually advanced, while the stupor and occasional excitement had disappeared. In the seventh month stupor, with negativism, appeared. She refused food, resisted everything, and displayed no voluntary activy. The stupor increased, the loss of weight and general paresis became marked, and death occurred in the sixth week of the stupor. The temperature was slightly subnormal during the last week, and at the time of the final blood examination on the day of the death was 93.4° F. in the axilla. A permission for a post-mortem examination could not be secured.

The blood examinations in this case were confined to the period of final stupor. The first examination was made in the second week of the stupor, at a time when the state had not become very profound, and the last about ten hours before death, the counts being made at

weekly intervals.

In the five examinations there was a rapid diminution of the percentage of the hæmoglobin from 85 to 60 per cent. for the first four, and then a final rise to 65 per cent.; the same change occurred in the count of the erythrocytes, which dropped from 5,488,000 to 3,711,000 and in the final week rose to 4,484,000. On the other hand, the leukocytes were below normal for the first two weeks and then showed an increasing leukocytosis, which reached 25,000 the day of her death. Throughout the whole period the increase in the number of leukocytes was largely represented by an increase of the polymorphonuclear leukocytes, which never fell below 82 per cent.

CASE VII.—In this case the disease appeared gradually at fifty-four years of age. At first it was noticed that the patient began to drink to

excess. He then became drowsy and heavy and slept a great deal of the time. Details of his work were overlooked, and he showed great irritability. Morally he lost his sense of propriety and was occasionally obscene. Under the influence of rest and total abstinence he gradually improved from the sixth to ninth month, and from the ninth to seventeenth months seemed "nearly well" and "perfectly natural."

In the seventeenth month, following exposure and overwork on the farm, he began to express delusions of grandeur and show some psychomotor restlessness, which with great irritability made his confinement in an institution necessary seven weeks later. At this time he presented some time disorientation; slight incoherence in his train of thought; impairment of memory and many changing delusions of grandeur of the most florid type, involving every sphere of life. There was also a pronounced feeling of well-being, with considerable emotional irritability and lack of moral feelings. His pressure of activity was confined mostly to an intense busyness, writing important letters, sending telegrams, etc. Physically there were exaggerated tendon reflexes, Argyll-Robertson pupils; muscular tremor, especially of facial muscles; inco-

ordination and greatly impaired articulation.

This condition of excitement greatly increased, and at the time of his first blood examination, one month later, was extreme. His sleep was greatly disturbed and he had lost nineteen pounds in weight. The excitement begau to abate in the second and third months, so that it was possible to keep him clothed. Suddenly the patient developed a stuporous condition over night. In the morning his consciousness was found to be greatly clouded, memory was much impaired, he was silent, and only fragments of his former grandiose ideas could be obtained by direct questions; emotionally the elation had been replaced by indifference, and his activity had mostly disappeared. Physically muscular exhaustion with increased tremor and inco-ordination had appeared, the countenance had become ashen and sunken. This stupor increased and death occurred thirty-six hours later, in the twenty-third month of the disease. During the week previous to the appearance of the stupor his weight fell eight pounds. The temperature was slightly subnormal during the stupor.

Consent for post-mortem examination could not be obtained, and the

diagnosis could not be verified.

The examination of the blood, which consisted of bi-weckly examinations, shows the hæmoglobin to have remained subnormal until the day previous to the appearance of the stupor, when it rose to 105 per cent. The erythrocytes were subnormal at the time of the first examination, but had increased 1,000,000 by the second examination, then they steadily fell with the slight abatement of the excitement until the day before the stupor, when with the hæmoglobin they rose to 5,088,000. The leukocytes were subnormal until the last examination, when they rose over 3000, producing a slight leukocytosis. In this elevation the polymorphonuclear leukocytes jumped up about 20 per cent., with a corresponding drop in the small lymphocytes, which had been 37.2 per cent. and 39 per cent., but with this exception the character of the leukocytes had been normal.

This case is of greatest interest because it shows the tendency to an abrupt rise in all three elements of the blood one day preceding the

appearance of the fatal stupor.

Case VIII .- At forty-six years of age this patient began to "fail in health," to lose in weight, and suffer from malaise; but it was not until seven months later that mental symptoms appeared, at which time he neglected his work, became loquacious and displayed a moderate feeling of well-being. A few somatic delusions were expressed, such as that he had revolving wheels in his head, which he feared would wear through the cranium and eause death, and his memory for recent events was impaired. He was admitted to the hospital three months later, when he was partially disoriented, and showed marked impairment of memory, some feeling of well-being, and motor restlessness. Physically he presented ataxia, general muscular tremor, faulty speech, Argyll-Robertson pupils, exaggerated reflexes, and impaired nutrition. In the course of two months the restlessness and loquaeity disappeared, consciousness cleared, somatic delusions vanished, and nutrition improved. Constant hallucinations of hearing, however, appeared, with delusions of infidelity and of reference, which made him despondent. It was at this time that the blood examinations were begun. He was orderly in conduct and an excellent helper in the ward.

His mental condition remained unchanged during the succeeding six months. The hallucinations of hearing continued and caused him much anxiety in reference to his wife. During the latter part of this period he suffered from insomnia and terrifying dreams and steadily lost in weight. The physical symptoms had not advanced. Without warning he suddenly became greatly agitated, reacted to numerous hallucinations of hearing, assaulted fellow-patients and attendants, resented his confinement, removed his clothing without purpose, and exhibited great motor restlessness. Consciousness remained clear. Food was refused and sleep completely abolished. At the end of the fourteenth day the patient became comatose and died forty-eight hours later.

During the quiescent period his weight gradually fell fourteen pounds, and during the final period of excitement dropped thirty-six pounds. The temperature was not taken, but from all external indi-

eations was normal.

A study of the tabulated record of the blood examinations shows that the erythrocytes throughout the period of quiescence, extending from the twelfth to the eighteenth month, with few exceptions, remained constantly normal and high normal. During the eight weeks previous to the terminal excitement there had been a gradual rise for seven weeks and then an abrupt drop of 900,000. In this same period the hemoglobin at first averaged about 89 per cent., when it fell and averaged during the last thirteen weeks about 82 per cent. The leukocytes at first continued about normal, but during the last thirteen weeks of this period fell to low normal, and sometimes even to 5000. The week previous to the exacerbation a leukocytosis appeared. In the differential estimation of the leukocytes we find that the polymorphonuclear leukocytes were always in excess of the normal percentage by ten to fifteen points, while the small lymphocytes presented a continuous lymphocythemia. The large lymphocytes were continually below normal during the latter part of this period.

The final period of the disease, that of the excitement, presents a marked change. In the first place, there was a progressive increase in the number of the crythrocytes after the second week, reaching, eight

hours before death, 7,551,000; the hæmoglobin showed a corresponding rise to 110 per cent. The leukocytes from the week preceding the exacerbation began to increase, and in the final count reached 27,000. The increase occurred entirely in the polymorphonuclear variety, which at the end averaged 91.6 per cent.

The post-mortem observations in the case verified the diagnosis of general paresis, and failed to reveal any cause for the leukocytosis.

CASE IX.—The onset of the disease occurred at forty-three years, six months previous to the patient's admission to the hospital. began to drink to greater excess, and when under its influence became violent. His work was abandoned while he spent his time loafing about the neighborhood. He presented a feeling of well-being, and in a short time expansive delusions appeared. He was shiftless and careless, and upon two occasions set the house on fire with ashes from his pipe, but on neither occasion made any effort to extinguish the flames. At the time of his admission he was still expansive and had a feeling of well-being. Deterioration was evident from his impaired memory and judgment and lack of emotional reaction. There was no increased activity, and consciousness was clear. Physically the pupils were unequal and irresponsive to light, tendon reflexes were absent, and there was faulty speech, general muscular tremor, moderate ataxia, and greatly disturbed speech. From the eighth to tenth months the expansiveness and feeling of well-being gradually disappeared, while the irritability increased, leading to occasional outbursts of passion with destructiveness. In the tenth month he suffered from his first epileptiform attack, preceded for a couple of days by lightning pains in his legs and followed by great restlessness and violent aggressiveness. During the following five months periods of composure with insight and fear of impending death alternated with periods of restlessness, irritability, and threatening and violent behavior. In the thirteenth month. the second paralytic seizure occurred, preceded by five days of excitement and followed by composure. During the sixteenth to twenty-first months he had a partial remission, with an improvement in memory, emotional attitude, and conduct.

The first blood examination was made during this remission, but the second examination was not made until the termination of the remission, with a stupor in the tweuty-first month. The examination was made on the second day of the stupor, when the patient was completely clouded, experiencing hallucinations of sight, incoherence of thought, and slight restlessness. On the same day an epileptoid spasm of the clonic form appeared, involving only the right upper and lower limbs, followed by hemiparesis of this side lasting some days. The stupor disappeared in the course of five days, but mental deterioration had advanced, and the patient presented greater languor, indifference, and irritability. For the three succeeding months he showed considerable gradual improvement. Dazedness again suddenly appeared in the twenty-fourth month, with evident hemiparesis of the left side, from which he never fully recovered He remained semistuporous for two months, was thoroughly disoriented, and memory for all of the events of his life was greatly impaired. During this time he suffered from an epileptiform attack involving the left side and followed by a partial paralysis of this side. The convulsive twitchings lasted several days. The quiescent stage followed from the twenty-sixth to the twentyninth months. Another and exactly similar seizure to the above, involving the left side and producing paresis, occurred in the twenty-ninth month. The twitching continued for four days. Two weeks later a slight clonic seizure occurred involving the left side. Three days following this the patient developed a comatose state, with twitching of the right hand, weakened pulse, and febrile temperature, appearance of bronchopneumonia on the ninth day, and death on the eleventh day.

The post-mortem examination disclosed the anatomical lesions char-

acteristic of dementia paralytica and also bronchopneumonia.

The study of the blood in this case began during the remission between the sixteenth and twenty-first months. At that time there was a moderate leukocytosis and a high erythrocyte count. The second examination was made on the second day of the stupor which followed the remission, and from this time examinations were made weekly until death. Six hours previous to the second examination the patient developed an epileptoid attack which lasted ten hours. Throughout this stupor the erythrocytes remained a high normal, with hæmoglobin varying between 85 and 95 per cent.; the leukocytes showed a leukocytosis 11,000 to 20,000, which reached its height in the second week. During the following ten weeks, while dementia was gradually progressing, the hæmoglobin remained high, for three weeks being above 100 per cent., but during the last two weeks falling below 75 per cent. The erythrocytes continued high, upon two occasions passing the 6,000,000 mark. The leukocytes fell abruptly to below normal, then rose slightly in the third, fourth, fifth, and sixth weeks, maintaining a slight lcukocytosis, and again in the eighth week reached 10,300. In the tenth week, on the day when the condition of dazedness suddenly appeared accompanied by hemiparesis, the leukocytes reached only 9500.

From this time until three weeks previous to death, while the mental condition did not change greatly, the progress of the disease was marked, however, by paralytic attacks. The hæmoglobin averaged 80 per cent., upon one occasion reaching 65 per cent., the erythrocytes remained about 5,000,000 until during the final eleven weeks, when they averaged about 4,700,000, except upon one occasion, when they rose to 5,546,000, and fell back again the next week without apparent reason. During the final comatose state of two weeks the erythrocytes

fell to 4,131,000, and on the day before death to 3,600,000.

The leukocytes during the period from the twenty-third to twenty-ninth month were mostly below normal, except near paralytic attacks. The week following the attack in the twenty-third month they reached about 10,500. They were then subnormal until the next attack, which lasted three days. The count was made on the day following the onset and showed a leukocytosis which continued into the next week. Four and five weeks later a leukocytosis appeared without any evident change of the mental symptoms. Likewise five weeks later and also seven and eight weeks later a slight rise above normal occurred. The next rise occurred thirteen hours preceding an attack, and again three weeks later a moderate leukocytosis accompanied another attack. In the coma which followed this attack and led to death the leukocytosis was 13,700, and one week later, the day previous to death, 10,700. In the differential count we find that during the periods of leukocytosis

throughout the disease the polymorphonuclear leukocytes predominated in percentages varying from 60.6 to 90.4 per cent., but upon only two occasions being below 70 per cent. His weight charts show a gradual fall from the twenty-third month, and during the last two weeks a loss of over ten pounds.

His temperature at the time of the blood counts did not vary over a degree from normal, except during his final illness, when it remained subfebrile, except at the final count, when it was 105° F., ten hours

after developing bronchopneumonia.

Case X.—The onset of the psychosis was gradual at the age of thirty-five years, with a pronounced change of character, the patient becoming irritable, very forgetful, and at times dazed. Within a month of the onset he had a paralytic attack, and following this the memory was more impaired, and he seemed uneasy, and could not apply himself to his work. His memory and judgment had so far deteriorated by the tenth month that he was incapable of doing any work. At this time he began to express delusions of grandeur and to exhibit a feeling of well-being.

He was admitted to the institution in the twelfth month of the disease, with profound deterioration in both memory and judgment, clouded consciousness, extremely expansive delusions, and a marked feeling of well-being. He was busy in planning various grandiose business adventures, and had no thought or feeling for his family. Physically he presented an absence of knee-jerks, Argyll-Robertson pupils, inco-ordination of lower extremities, faulty articulation, general muscular tremor, absence of facial expression, and impaired nutrition.

During the first month after admission the patient showed some improvement, his consciousness became clear, the expansive delusions were less prominent. He became interested in his environment and was an excellent, energetic ward helper. Physically his state of nutrition improved greatly, and his weight rose seventeen pounds. There was no further change in his condition from the thirteenth to the twenty-third month. The blood examinations had been begun during the

quiescent period.

In the twenty-third month the patient gradually developed a condition of stupor, he lost his former interest, stood about in one place unobservant, seemed unable to comprehend questions, and answered very slowly, giving evidence of difficulty of thought. All the delusions had disappeared and he expressed some insight into his condition. He was confined in bed. In seven days his stupor had deepened so that he did not respond at all to questions, and had to be fed by spoon. His weight continued to fall rapidly and his countenance became ashen. On the fourth day his temperature rose to 104° F., then fell to subnormal for two days, and from that time continued to show a slight afternoon rise to about 99.6° F. The stupor became more profound, and he died on the fourteenth day. In the two weeks his weight had fallen from 151 to 107 pounds.

In reviewing the blood charts of weekly counts which began during the quiescent stage at the seventeenth and one-half month of the disease we find that the hæmoglobin remained constantly low throughout this period. Upon three occasions it rose above 90 per cent., once to 93 per cent., and fell as low as 74 per cent.; its average, however, was 84 per cent. During the seventeenth and eighteenth months it varied

between 87 and 93 per cent., while during the final two months it varied between 88 and 74 per cent. During the period of stupor it fell at first to 65 per cent., and then rose gradually to 90 per cent. at the final count—four days before death.

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The erythrocytes during the period of quiescence remained mostly normal, three times they rose above 5,500,000, and once to 5,871,000, until they fell with the hamoglobin, and from that time until the final stupor remained below 5,000,000, once reaching 4,500,000. During

the stupor they gradually rose from 4,500,000 to 6,500,000.

The leukocytes, similarly with the erythrocytes, remained about normal, with one exception, when they rose to and over 10,000, then fell and were subnormal, averaging about 5,000. During the first part of the stupor, while it was still not profound, they rose gradually to normal, and then passed into a state of leukocytosis.

In reference to the relation maintained by the different forms of leukocytes we find that the polymorphonuclear leukocytes were about normal until the appearance of the leukocytosis, when they rose to

80.4 and 86.2 per cent.

During the final stupor there was a pronounced lymphopenia, while the large lymphocytes remained at the same percentage.

The autopsy in this case substantiated the diagnosis of dementia

paralytica.

CASE XI.—This patient developed dementia paralytica at the age of thirty-six years, but did not come under our care until one and one-

half years later.

At this time he presented as evidences of the disease an impairment of memory, some clouding of consciousness, emotional deterioration, and increased motor activity, and an extremely limited content of thought. Physically he presented a very pronounced choreiform condition, which simulated very closely advanced Huntington's chorea; also exaggerated deep reflexes; tremor of the muscles of the face, tongue, and hands, inco-ordination of the limbs and facial muscles, and a moderately defective speech. In reading there was an elision and an occasional

translation of syllables. He was also poorly nourished.

The patient was in this same condition at the time the blood examinations were begun, which was in the twentieth month of the disease, one and one-half months after admission. His condition did not change until the latter part of the twenty-third month, when he would become dazed for a few hours at a time. While in this state he was completely clouded, and would fail to respond to the dinner call. In three weeks he gradually passed into a stuporous state. The duration of this stupor was from February 19th to April 14th, when he emerged from the condition during a night. The next morning he was active and interested, asked for work, and talked freely of his war experiences. There was no motor restlessness. His condition of deterioration had apparently not advanced during the stupor, while the choreiform condition had greatly improved and was now confined entirely to the muscles of the face.

A condition of stupor, similar in every respect to the former one, came over him suddenly on June 30th, ten weeks later. On the morning of the tenth day he seemed somewhat improved, as he voluntarily went to the bath-room; a few minutes later he fell in a convul-

sion and expired in three minutes.

The post-mortem examination in this case substantiated the diagnosis

of dementia paralytica.

In this case the blood examinations were begun during a condition of moderate paretic excitement, which persisted until the gradual appearance of a stuporous state in the twenty-third month. During the first three months only four examinations were made. Following this for three months they were made weekly, and during the last two months bi-weekly. During the first three months the hæmoglobin varied between 70 and 95 per cent., the erythrocytes were normal, with one exception, when they fell to 4,511,000, and the leukocytes were low normal and subnormal. During the stupor of two months' duration the hæmoglobin varied from 65 to 85 per cent., the erythrocytes increased from subnormal to above normal, and then fell to normal; the leukocytes averaged low normal. In the period of two weeks' intermission the hemoglobin varied from 68 to 80 per cent., the erythrocytes remained normal, and the leukocytes averaged normal. No blood count was made during the eleven days previous to the onset of the second stupor, and the final examination was made six days before death. This examination revealed a normal count, with the exception of the low hemoglobin and the high percentage of the polymorphonuclear leukocytes (77.8 per cent.).

The clearly defined periods of stupor are not indicated by a definite blood change. The weight, on the other hand, shows a progressive drop from the time of the first examination to the time of death, a loss

aggregating forty-four pounds.

TECHNIQUE. The blood has been drawn from the finger, preferably a middle finger, precautions being taken to avoid the application of friction and pressure. The hemoglobin has been uniformly estimated with a Fleischl's hemometer, attention being paid that all excess of blood is carefully wiped from the end of the capillary tube. The erythrocytes have been counted with a Thoma-Zeiss hemocytometer, the same pipette being used for practically all of the work. In using Gower's solution, making a dilution of 1:200, an attempt has always been made to place the cover-slip over the Zappert counting chamber as rapidly as possible after placing the blood in the chamber. Two large squares in each of two drops and one in the third drop, preferably squares near the periphery, have been counted in making the estimation. Wherever there was great variation another drop has been counted, and the three counts nearest each other selected in making the aggregate.

In counting the leukocytes acetic acid solution, with a dilution of 1:20, has been uniformly employed. Three fields of four hundred squares each have been counted in each case, and if there was a great variation an additional field was counted.

As regards the personal equation, the greatest part of the work has been done by a single observer. The work was begun by Mr. Burr, laboratory technician, in the spring of 1901 (thirty counts), continued by Mr. Stone, medical interne (sixty counts), and completed by Mr.

Ward, technician, all of whom had had considerable experience in blood work. Besides this, parallel counts were made to determine the presence of any error due to personal equation.

In reference to the condition of the patient, every precaution was taken to have the work uniform. In most cases the examinations were made weekly, occasionally bi-weekly. They were made at the same time of day, either two hours after breakfast or an hour and one-half after a dinner, and on the same day of the week. All patients were on uniform diet.

In enumerating the different forms of leukocytes, five hundred cells were counted.

Hæmoglobin. In interpreting the results of our observations the standards established by Reinert in his extended series of observations upon normal individuals have been followed. The results of Reinert have been confirmed in great part by Mr. Ward, who also made a series of twenty-four-hour counts upon normal individuals. In order to ascertain if daily pathological variations occurred in the paretic, a similar series of twenty-four-hour counts was made by him in one of the patients.

In all of the eleven cases the observations were necessarily confined to a period of the disease in which the disease process was already well established.

The hæmoglobin in all cases showed a moderate anæmia, which became more marked, but never profound (below 65 per cent.) as the disease advanced. In cases where the hæmoglobin was below 80 per cent. at the time of the first examination it did not subsequently vary much.

During the terminal state the average percentage of hæmoglobin in all but three of ten cases (IV., V., and X.) was from 3 to 20 per cent. higher than during the period just preceding. Of the three cases in which the rise in hæmoglobin was not coincident with the onset of the terminal state, there is in one a rise in the last four weeks from 65 to 70 per cent., in another during the last three weeks a rise from 65 to 90 per cent., and in the third case a rise in the last week (two counts) from 76 to 86 per cent. The only exception to the increase of the percentage of hæmoglobin in the terminal state is found in Case VI., in which the blood was examined only during this period. In this case there was a progressive drop in four weekly counts from 85 to 60 per cent. In reference to the relationship between the condition of nutrition

In reference to the relationship between the condition of nutrition and the percentage of hæmoglobin, four of the eleven cases were well nourished throughout the period of examination until just preceding and during the terminal state, and seven were poorly nourished. The hæmoglobin in the well-nourished cases averaged only 4 per cent. higher than in the poorly nourished—78 and 82 per cent. In two of

the well-nourished cases the hæmoglobin reached 100 per cent., and plus three times in one, and once in another case and three times in one of the poorly nourished patients.

The hæmoglobin during the various paretic states of quiescence, of excitement and stupor, not terminal, present no constant change, characteristic either of different states in the same individual or of similar states in different individuals. There was no increase in the percentage of hæmoglobin during the quiescent period, when nutrition regularly improved.

ERYTHROCYTES. The erythrocytes in eight cases in which the examinations extended over many months averaged normal in all, while in the two cases (III. and VI.) in which the examinations were made only during a short period previous to death the average was low normal, but in no case was there an average subnormal count. Occasionally the cells sank to low normal, but in only five instances did they fall to subnormal; in one case once, in one case twice, and in one case three times. In the last two of these cases it occurred at the very end of the disease.

In all cases the erythrocytes showed a tendency to sink during the period just previous to the terminal state, and then there occurred during the terminal state, with only one exception, a rise which is even more marked than that seen in the hæmoglobin during the same period. This rise varied from 5000 to 3,000,000, and in four cases became a polycythæmia. This rise was exactly coincident with the beginning of the terminal state in only five of the ten cases.

The various paretic states, exclusive of the terminal state, namely, those of excitement, of stupor and quiescence, failed to exhibit any change in the erythrocytes. In the five cases of paretic excitement the count averaged normal in all but one, which was subnormal. In the two cases with the greatest excitement, in one of which there were two periods of excitement, the count averaged normal in one case and in one period of the other, and low normal in the other period. In the individual cases the count during the period of excitement averaged the same in two cases and lower in one. In one of the two cases in which it was higher the excitement occurred early in the disease, when the erythrocytes are naturally higher.

Stupor occurred twice in each of two cases. In three of these four stuporous states the count averaged normal, and in the other subnormal. In the individual cases the erythrocytes averaged higher during the period of stupor in one case and lower in the other.

Periods of quiescence could be studied in eight cases, in one of which it occurred twice. In five of these periods the count averaged normal, in two low normal, in one high normal, and in one polycythæmia. In the individual cases the erythrocytes during the period of quiescence averaged about the same as during the other periods of the disease in

three cases, lower in one case, and higher in the fifth case. In the remaining three cases there were no other paretic states except the terminal with which to compare it.

As regards the relationship between the condition of nutrition and the number of erythrocytes, the gradual, though not marked diminution in the number of cells as the disease advanced corresponded with the gradual loss of weight, except in the terminal state, when there was a tremendous loss of weight, but a considerable increase in the number of cells. In the three well-nourished cases (I., VIII., and X.) the erythrocytes averaged only a very little higher than in the poorly nourished cases.

In making the differential counts no qualitative changes of any moment were noted in any of the cases. Occasionally poikilocytosis, and now and then a single normoblast or a myelocyte, was found.

Paralytic attacks occurred in three cases. No appreciable change was observed in the erythrocytes near these times. In Case IX. the count was made at the time of the first attack, about six hours after the seizure; at the second, eighteen hours before; at the third, twenty hours afterward, and at the fourth, three days later. In Case I. the examination was not made until forty-eight hours after the attack. In Case V. the count was made a few hours after the termination of an epileptiform status of twenty-four hours' duration.

LEUKOCYTES. The study of the leukocytes does not show uniform In the cases in which the study extended over many months, the leukocytes presented a gradual fall in three cases, in three cases they were low at the time of the first examination and continued low, while in three cases they varied throughout the entire period. in all of these nine cases just preceding, coincident with or following the onset of the terminal state, there appears a risc in the number of the leukocytes, which in all but two reaches a leukocytosis. leukocytosis varies from 10,700 to 27,000. In the two cases which did not reach a leukocytosis there is a rise in one of 1000 and in the In three cases the height of this leukocytosis occurs other of 3000. before the final examination; in Case IX. there is a fall of 3000 in the last four days; Case V., a fall of almost 3000 in the last four days; and in Case I., a fall of 10,400 in the last five days. In the two cases in which the examinations are confined to the terminal state, there is in one a gradual rise from 6300 to 25,000, and in the other a lcukocytosis which rose from 10,000 to 14,000.

The paretic states of excitement, of stupor and quiescence, exclusive of the terminal states, did not present any characteristic change. In the four periods of stupor—two cases—there was a constant leukocytosis in one, an average normal count in two, and a low normal in one, but in two of these periods a leukocytosis appeared transitorily. In six periods of excitement—five cases—there was an average hypoleukocy-

tosis in three, an average normal count in two, and a leukocytosis in one. Besides this a leukocytosis appeared transitorily in one period of excitement. In the nine periods of quiescence—eight cases—an average normal count was present in four, a leukocytosis in one, a hypoleukocytosis in two, low normal in one, and a high normal in one, but in seven of these periods a moderate leukocytosis appeared temporarily.

The percentage of the different forms of leukocytes, shown by the differential counts, presents a striking abnormality. A uniform pathological increase of the polymorphonuclear variety occurred in ten of the eleven cases. In this one, Case VIII., the percentage of polymorphonuclear leukocytes remained within normal limits with two exceptions; once it fell to 53.8 per cent., and once it rose to 71.8 per cent. This pathological increase became more pronounced and reached its climax, with one exception, during the terminal stage. In Case II. the highest point is touched during a stage of excitement some months previous to the terminal state, but the average highest percentage occurred during the terminal state.

Plasma cells were carefully looked for in the differential counts, but never encountered. This observation is of importance because of the prominent rôle played by these cells in the vascular changes in the brain, which has come to be regarded as a pathognomonic condition.

The opportunity for observing the condition of the leukocytes near paralytic attacks was limited, as in the eleven cases only six attacks occurred-four in Case IX, and one each in Cases I, and V. In Case I., in which the count, made two days after the attack, was 8300, it is practically of no value. In Case V. the count, made a few hours after the termination of an epileptiform status of twenty-four hours' duration, was 17,200. This was in the terminal state, and five days later, three days before death, the count had dropped 3000. In Case IX. a count was made six hours after the first attack and showed a leukocytosis of 14,000. One week later the count was 19,000 without any apparent reason, except that the patient was still in stupor. The count was made in the second attack twenty-four hours later and showed a leukocytosis of 13,900, which was a rise of over 7000 above the average of the preceding weeks. Two days later the count was 14,600. third attack the count made eighteen hours before was 10,300, while for the two previous examinations it was under 7000, and the two subsequent examinations under 8500. In the count made three days following the fourth attack, which was during the terminal state, the leukocytosis reached only 10,000, which was a rise of 2000 over the previous count.

In reviewing the blood changes observed in the hæmoglobin and erythrocytes, there are only two conditions requiring special comment: the progressive moderate anæmia, and the tendency to a polycythæmia and increase in the percentage of the hæmoglobin in the terminal

state. The anæmia, which is more apparent in the hæmoglobin than in the red cells, is similar to that which accompanies chronic diseases; as, chronic nephritis, cirrhosis of the liver, and syphilis, except that it is less pronounced. It is in accord with the progressive atrophy of the nervous system accompanied by a gradual and complete loss of function, as well as atrophy and arteriosclerotic changes occurring in the internal organs. The tendency for this anæmia to disappear and to be replaced in the terminal state by a progressive increase in both elements, which in some cases passed the normal limits, does not, as far as recorded, find its counterpart in other diseases, and is more difficult of explanation. The most rational explanation would be that it was due to a concentration of the blood, dependent upon a lack of ingestion of fluids and food during the terminal period. This did occur in the paretics during the latter part of the terminal period, and in some cases the abstinence was complete during the last few days.

In order to determine the importance of this factor several moribund cases suffering from inanition were studied. In six such cases in which the examination was made from four to twenty-seven hours ante-mortem, and in which there was an absence of the ingestion of food and water, as well as an absence of temperature or demonstrable inflammatory condition, the hæmoglobin was found to be low in all cases except one (93 per cent.). The erythrocytes in these cases were within normal limits except in this one case, in which they reached 6,155,000. Sluggish circulation was evident in the moribund cases as well as in the moribund paretics, by the slow flow of the blood and by the appearance of an extremely dark-colored drop at the point of puncture. Judging from these facts one feels safe in the assumption that the high percentage of hæmoglobin and the tendency to a polycythæmia of the terminal paretic state is not due to concentration of the blood dependent upon lack of ingestion of food and fluids or to the weakened heart's action and sluggish circulation. Furthermore, this condition of the paretic blood was in the majority of cases coincident with the onset of the terminal state and was in existence some days or weeks before the moribund state appeared.

The two pathological conditions observed in the leukocytes which merit comment are the appearance of a terminal leukocytosis coincident or nearly so with the terminal mental state and the presence of a leukocytosis accompanying paretic attacks of an epileptiform nature. In considering the terminal leukocytosis one must eliminate the presence of any inflammatory conditions which might give rise to it. In Case IX. bronchopneumonia appeared two days before death. The final count was taken ten hours later and showed a fall in the leukocytes from 13,700 to 10,700. With this exception there was no physical

¹ Prof. Ewing informs me that he has observed a somewhat similar tendency in isolated cases of caneer and of tuberculosis.

sign of any inflammatory process in the five cases not examined postmortem, and no pathological evidence of it in the six cases in which an autopsy was performed.

This leukocytosis should not be confounded with the moribund leukocytosis mentioned by Cabot and other writers, as it appears some time before the moribund state. In accord with their statements it might be added that our six moribund cases, examined from four to twenty-seven hours ante-mortem, showed a leukocytosis varying from 13,000 to 17,000, being highest in the cases four and five hours ante-mortem. Moribund leukocytosis is believed to arise either from stasis or from terminal "intoxication." The former explanation cannot apply to prolonged terminal paretic leukocytosis, as the sluggish circulation and weakened heart action did not appear until just previous to death. The preponderance of experimental evidence goes to prove that leukocytosis should be regarded as a reaction to the presence of a chemical substance in the blood, the function of the leukocytosis being to remove these substances.

The only chronic non-febrile non-inflammatory disease process comparable with dementia paralytica in which a terminal leukocytosis has been observed is chronic nephritis, terminating in uramia. In this disease Cabot found an absence of leukocytosis in the great majority of cases during the progress of the disease until the uramic state when leukocytosis appeared in thirty-four of forty cases. This concurrence is most significant, not only in establishing the toxic origin of the terminal state and its leukocytosis, but also the toxic origin of the disease.

The presence of the leukocytosis accompanying paralytic attacks has already been established by Capps. Our limited observations on this matter simply bring additional evidence. In explanation of this phenomena, here again the only recourse is to the toxic theory. The only disease presenting symptoms comparable with the paralytic attacks of dementia paralytica is idiopathic epilepsy. The blood conditions in this disease have been studied by Kroubmiller and Pugh. Kroubmiller studied twelve cases, and claims that at the time of the attack the total quantity of leukocytes is increased and that the increase diminished with every new attack. It is highest one hour after the attack. increase is due to the relative and absolute increase in the lymphocytes with a relative decrease of the other cells. Pugh' studied twenty cases of idiopathic epilepsy. His observations were confined to a single examination from one to twenty-four hours after the occurrence of one or more convulsions in seventeen of the cases, and in three cases an examination also in the interparoxysmal period. He found that a leukocytosis occurred following seizures, which diminished with each convulsion following the first and was less marked in epileptic status.

In this leukocytosis there was an increase in the small and large lymphocytes and a diminution of the polymorphonuclear variety.

These observations in epilepsy, which are in accord with the results of Capps and our own in dementia paralytica, add further weight to the toxic theory of the origin of this disease.

The question naturally arises, if this theory be true, Why are not the states of paretic excitement and stupor, which clinically seem to indicate an intensification of the toxic state, accompanied by a leukocytosis? It is a recognized clinical fact that the paralytic attacks are regularly followed by greater mental impairment. The same is true of the excited and stuporous states, at which times the disease usually makes greater inroads upon the mentality of the patient. Furthermore, a similar condition appears to exist in the terminal state whether the outward manifestations are those of excitement, stupor, or simple inanition. The only explanation for the absence of a leukocytosis in the parctic excitement and paretic stupor not terminal is that the toxic state is not intense enough to produce it.

A further pathological change which occurs in striking uniformity is the increase of the polymorphonuclear variety of leukocytes throughout the course of the disease, for which we can offer no explanation.

The results of this systematic examination of the paretic blood corresponds with those obtained by earlier investigators in reference to the progressive anamia, but they controvert the observation of Smyth that there is a cessation of the progressive fall of hæmoglobin during periods of great exaltation. The recorded observations on the leukocytes have been: a diminution at the end (Macphail), a diminution in seven of fourteen cases (Jelliffe), a slight increase (Somers), a moderate leukocytosis, except near the onset (Capps), and leukocytosis with the exalted state (Jelliffe). Our study does not accord with any of these views, though examinations made irregularly during the course of the disease in any of our cases might easily have brought results in accord with all of them, except those of Capps in reference to the leukocytosis accompanying paralytic attacks. The observation of Jelliffe that a leukocytosis accompanies exalted conditions is improbable, as it occurred in only one of six exalted periods.

Conclusions. Dementia paralytica is accompanied by a moderate and progressive anemia, involving, especially, the hemoglobin and becoming more marked as the disease progresses.

The terminal state of the disease is accompanied by a rise in the hæmoglobin, erythrocytes, and a leukocytosis.

Paralytic attacks are accompanied by a lcukocytosis.

Throughout the disease process there is a pathological increase of polymorphonuclear leukocytes which reaches its height during the terminal state.

States of paretic excitement, stupor or quiescence, not terminal, are not accompanied by any characteristic blood changes.

The presence of a leukocytosis accompanying the terminal state and paralytic attacks is significant evidence in favor of the toxic origin of the disease.

I desire to express my appreciation of the faithful work done by Messrs. Burr, Ward, and Stone in making the blood-counts, and particularly the assistance given by Mr. H. C. Stone in compiling the statistics of the counts and in arranging the histories of the cases.

The accompanying tables represent only the terminal stage of the disease, and in some cases a part of the period just preceding.

TABLE I.

Month of disease.	Hæmo- globín.	Erythro- cytes.	Leuko- cytes.	Poly, leu- kocytes,	Small lympho-	Large lympho- cytes.	Eosíno- philes.	Weight.	Temper- ature.	Stages of the disease.
Case No. 1. 25th mo. 4th 25th " 11th 25th " 18th 25th " 25th 26th " 2d 26th " 15th 26th " 17th 26th " 17th 26th " 19th 26th " 12th	77 70 85 78 78 70 82 80 93	4,613,000 4,653,000 4,933,000 5,166,000 5,534,000 5,475,000 5,631,000 5,457,000 6,356,000	5,000 5,803 6,000 7,266 8,300 11,533 9,100 23,900 22,900 13,500	78.6 61.8 83.2 89.6 65.5 81.2 92.0 96.0 95.6 92.8	18.6 12.6 14.0 9.8 10.2 14.2 5.8 2.8 3.0 6.0	2.2 5.6 2.4 2.0 4.0 4.0 4.0 1.2 1.4	0.6 0.4 0.6 0 0.2 0	143 141 134 131 119 118 100 	Normal	Moderate excitement, Terminal great excitement.

TABLE II.

Case No. 2.				
17th mo. 9th 72	4,568,000 8,400	85.2 12.2 2.2	0.4 102	Normal
17th " 23d 80	5,786,000 5,600	83 4 11.4 3.6	1.6 97	
17th " 30th 89	5,306,000 10,533	80.8 14.2 4.4	0.6 97	" Quieseent.
18th " 7th 70	5,671,000 8,400	80.0 13 2 6.0	0.8 94	
18th " 15th ; 62	5,453,000 8,200	79.6 14.0 4.2	2.0 94	:
18th " 22d ; 83	5,182,000 9,100	77.6 16.8 4.6	1.0 92	
18th " 29th 67	4,888,000 8,400	90.0 6.6 3.4	0 88	Terminal stupor.
19th " 4th 82	5,982,000 16,100	86.4 9.8 3.2	0.6 79	
15111 4111 02	0,234,000 10,100	00.4 0.0 0.2	13	, stupor.

TABLE III.

Case No. 4.	i	,			
18th mo. 2d 65 18th " 16th 68 18th " 31st 70 19" " 12th 70	4,916,000 10	7,000 78.8 7,160 81.6 1,700 86.2 1,660 94.2	16.0 5.0 15.2 2.4 9.4 4.4 3.8 2.0	0.2 0.8 0 0	Normal Terminal stupor.

TABLE IV.

Case No. 5 16th mo. 5th 16th " 12th 16th " 19th 16th " 26th 17th " 2d 17th " 5th 17th " 9th	83 5,133,000 83 5,442,000 85 5,622,000 85 5,724,000 86 5,724,000 76 5,162,000 86 6,333,000	7,600 82.2 6,700 84.0	13.1 4.5 10.4 6.0 10.3 4.0 10.0 4.4 11.6 3.6 3.6 3.2 4.0 1.4	1.1 1.4 1.7 0.8 0.4 	111 Normal 110 " 110 " 109 " " 85 "	Excitement. "" "" "" Terminal stupor.
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¹ Could not be taken.

² Could not be taken.

TABLE V.

				TAI	BLE V	•				
Month of disease.	Hæmo- globin.	Erythro- cytes.	Leuko- cytes.	Poly, leu- kocytes.	Small lympho- cytes.	Large lympho- cytcs.	Eosino- philes.	Weight.	Temper- ature.	Stages of the disease.
Case No. 6. 7th mo. 31st 8th " 10th 8th " 17th 8th " 26th 9th " 2d	85 70 68 60 65	5,488,901 4,573,000 4,769,000 3,711,000 4,484,000	6,800 6,500 10,000 17,720 25,000	82.2 86.2 85.0 93.0 83.0	12.8 7.8 9.4 2.6 14.0	4.6 5.4 4.4 4.4 2.2	0.4 0.6 1.2 0 0.8]1	Normal 99.4 98.6 96.4	Terminal stupor.
			-	Тав	LE V	I.				
Case No. 7. 19th mo 18th 20th " 6th 20th " 20th 21st " 8th 21st " 22d 22d " 5th	70 85 86 76 78 105	4,516,000 5,293,000 5,053,000 4,244,000 4,400,000 5,089,000	6,600 5,533 5,030 6,300 5,900 9,060	70.6 66.0 71.8 53.8 54.4 71.8	21.2 24.4 24.6 37.2 39.0 20.2	6.2 6.8 2.4 8.2 3.6 4.2	2.0 2.8 1.4 0.8 3.6 0.8	113 107 100 111 112 104	Not taken	Excitement. "" "" Terminal stupor.
				TABI	LE V	u.				
Case No. 8. 11th mo. 29th 12th " 5th 12th " 12th 12th " 19th 12th " 26th 12th " 27th 13th " 2d	85 85 90 97 102 105 120	5,800,000 4,942,000 5,408,000 4,693,000 6,302,000 6,373,000 7,551,000	7,400 10,660 10,900 16,500 17,800 17,920 27,000	80.4 84.0 81.4 92.0 79.2 81.8 91.6	13.2 10.2 13 2 5.6 14.6 15.6 6.0	5.2 4.0 4.0 2.0 5.2 1.6 2.0	1.2 1.8 1.4 0.2 1.0 1.0	157 157 155 128 121	Normal	Quiescent. Terminal excitement.
			,	T ABL	e VI	II.				-
Case No. 9. 29th mo. 29th 30th "5th 30th "12th 30th "18th 30th "22d	82 73 80 78	5,547,000 4,500,000 4,700,000 4,131,000 3,600,000	7,750 8,666 10,000 13.730 10,700	76.6 76.4 87.4 84.8	17.2 15.4 7.0 11.6	4.2 6.0 5.2 3.2	2.0 2.2 0.4 0.4	145 145 139 129	97.2 99.6 99.6 105.0	Terminal stupor.
				Тав	LE IX	ζ.				
Case No. 10. 24th mo. 8th 24th " 15th 24th " 22d 24th " 30th	65 78 80 90	4,538,000 4,889,000 5,333,000 6,271,000	5,100 7,000 8,200 15,860	76.4 65.0 80.4 86.2	20.4 28.2 12.8 6.8	2.6 5.6 5.2 6.8	0.6 0.6 1.6 0.2	161 107	Normal	Terminal stupor.
		•		TAR	LE X					
Case No. 11. 26th mo. 8th 26th " 24th 27th " 5th 27th " 19th 28th " 2d	80 68 75 80 78	5,533,000 4,862,000 4,747,000 5,328,800 5,833,000	7,860 6,000 8,860 7,260 8,800	74.2 76.0 82.2 81.4 77.8	22.4 19.6 14.2 14.8 17.2	3.2 4.2 3.2 3.6 4.4	0.2 0.2 0.4 0.2 0.6	144 137 137 131 130	Normal "" ""	Qniescent. " " Stupor.

¹ Could not be taken.

REVIEWS.

A MANUAL OF PRACTICAL HYGIENE. By CHARLES HARRINGTON, M.D. Second edition. Pp. 760. Illustrated with engravings and colored plates. Philadelphia and New York: Lea Brothers & Co., 1903.

Ir would be difficult to imagine a book better fulfilling the needs of the general reader and at the same time containing the essentials of a book of general reference on hygiene. The author has considered not only the more generally known phases of the question, but also the recent problems of prophylaxis. The first quarter of this most readable volume is devoted to Foods, with special reference to their nutritive value, and then their contaminations and adulterations, with the more simple methods of detecting the latter. A chapter on the Air follows, giving in detail its normal constituents, extraneous concomitants, and methods of analysis. Then come chapters on Soil and Water, the latter being especially valuable for the clear description of the general principles of water supply and the danger of spread of infectious diseases when this most important subject of public health is carelessly dealt with. Habitations are treated in reference to ventilation, lighting, and plumbing. In logical sequence are discussed the subject of Sewage and Disposal of Garbage; Military and Naval Hygiene and Quarantine are given in their essentials. Of particular interest is the chapter on the Relation of Insects to Human Diseases, in which malaria, yellow fever, and filariasis are detailed in their recent developments. The prevention of disease by means of specific vaccination is dealt with in a thoroughly modern fashion. References to the periodical literature are given in footnotes sufficiently to aid further reading without alarming one by their number. The presentation of the text is excellent, and the book is fully illustrated. In short, it is a volume to which one may go for specific information, and the subjects are presented so attractively withal that he would be apt to turn over the next leaf.

Text book of Medical Jurisprudence and Toxicology. By John J. Reese. Sixth edition. Revised by Henry Leffmann, M.D. Philadelphia: P. Blakiston's Son & Co.

This useful compendium of toxicology and medical jurisprudence, which has reached its sixth edition, has been brought up to date through the able editorship of its reviser. In his preface to this edition the latter says that "the introduction of numerous synthetic organic bodies, and the extensive use of some of them as household remedies, has given rise to

many instances of accidental and suicidal poisoning. Current medical literature shows that phenol is becoming one of the most common agents of self-destruction, while the extensive use of water-gas greatly increases the list of accidental poisonings." The difficulties and perplexities of the analyst are greatly increased by the absence of tests which are conclusive of the presence of many of these synthetic bodies, and those of the postmortem examiner rendered only less pronounced through the want of distinctive appearances upon which their action is unmistakably to be

In the chapter on the Examination of Blood Stains a brief reference to the use of the precipitin test is made. This test has come, within the relatively short period since its introduction into medicolegal use, of such great importance that a fuller treatment in the volume before us would have seemed advisable. In view of the frequency with which blood stains come up for consideration by the medicolegalist, and the high importance of an indubitable statement as to their nature, minute directions for carrying out the test, its scientific and practical limitations, and perhaps a brief reference to cases in which it has already been employed, might not have been out of place.

In the section on Burns and Scalds the cause of death in severe cases is still given as the extensive loss of the skin surface and interference with the function of secretion and heat regulation. This view is not upheld by more recent studies in which more definite effects are easily ascertained and are sufficient to account for the severe and fatal results. The production of extensive thrombi and their consequences as well as the action of "tissue poisons," the outcome of tissue destruction, are entirely competent to explain the otherwise mysterious symptoms following upon severe superficial burns.

The volume before us has many valuable features that far outweigh the very occasional omissions of more recent knowledge on a few of the subjects included in its scope. It can be recommended in its new edition as

heartily as ever in its older editions.

BIOGRAPHIC CLINICS. The Origin of the Ill-health of De Quincey, Carlyle, Darwin, Huxley, and Browning. By George M. Gould, M.D. Philadelphia: P. Blakiston's Son & Co., 1903.

In this unique little work Dr. Gould not only studies the lessons to be drawn from the lives of the five men whose names appear upon his titlepage, but also deducts from the study of their lives the practical points which bear upon the life-histories of all our patients. In each of the instances which Dr. Gould has chosen for his study there is very complete biographical material at hand, from which it is possible to construct an intimate personal history of the various pathological conditions pre-In each instance the cause of the profound gloom which at times enwrapped them, and of their constant complaint of dyspepsia, vertigo, and innumerable other physical ills, the author thinks are distinctly traceable to the eye, stating the reason as uncorrected astigmatism. This theorem he supports by many ingenious arguments.

The only real criticism to our mind which can be offered in contradiction to what Dr. Gould so ably advances is that at times his enthusiasm

has led him to make inferences which we would regard as not wholly supported by the facts at hand; thus in pointing out that the long walks, rides, etc., which always benefited each one of the victims whose case is described in this book did them good by the rest of the eyes which was necessarily induced, we are inclined to think that possibly also the long walks, rides, etc., might be held to have benefited the liver and

general condition quite as much as the eyes.

There are a few curious typographical errors. On page 160 Norris and Oliver's System of Diseases of the Eye is attributed to Morris and Oliver. On page 184 Dr. Pray is said to have described his test type Oliver. On page 184 Dr. Fray is said to have described his test type for the diagnosis of astigmatism in 1869, the bibliographical footnote stating that the paper appeared in The American Journal of the Medical Sciences for January, 1867. The book is one of value to all who do literary work, as well as to physicians, and we sincerely trust that it will meet with the favorable reception it most certainly deserves. F. R. P.

MANUAL OF GYNECOLOGY. By HENRY T. BYFORD, M.D., Professor of Gynecology and Clinical Gynecology in the College of Physicians and Surgeons of Chicago. Third revised edition, containing 363 illustratious, many of which are original. Pages 598. Philadelphia: P. Blakiston's Son & Co., 1902.

In this edition the author has brought the subject up to date by the addition of much new matter. The field of gynecology is fully reviewed in a manner which will be found quite satisfactory to the medical student and to the busy practitioner who may wish to refresh his memory. The system of marginal notes and the avoidance of repetition by the use of so many text references may be of value to the student who is preparing for an examination, but it is not good literary form, and makes awkward and disjointed reading. The book is extensively and well illustrated; the illustrations of many pathological conditions being selected from the best works on the subject are especially valuable. The teaching is wise and conservative, and while there are many views expressed which are still open to discussion, especially under the head of pathology, still there is little to criticise, and the book is a safe guide for the student and the practising physician, for whom it is intended.

A MANUAL OF OBSTETRICS FOR STUDENTS AND PRACTITIONERS. By W. P. MANTON, M.D., Adjunct Professor of Obstetrics and Professor of Clinical Gynecology, Detroit College of Medicine. Philadelphia and New York: Lea Brothers & Co., 1903.

As an aid to the student or practitioner of medicine, Dr. Manton's book will prove of much value. It is, as its name implies, an epitome or condensation of the essentials of the science of obstetrics, and the author has so compiled his volume as to render it much more complete than it is usual to find such works. A feature which will be found of

much service to students preparing for examinations is a set of questions at the end of each chapter, on its contents. The entire work reflects much credit upon its author, and, although intended, primarily, for the use of students, it will be found a most handy little work of reference for the practising physician, containing as it does the most advanced work in the science and art of obstetrics.

W. R. N.

Burdett's Hospitals and Charities, 1903. Being the Year Book of Philanthropy and the Hospital Annual. Containing a review of the Position and Requirements, and chapters on the Management, Revenue, and Cost of the Charities. An exhaustive record of Hospital work for the year. It will also be found to be the most useful and reliable guide to British, American, and Colonial Hospitals and Asylums, Medical Schools and Colleges, Nursing and Convalescent Institutions, Consumption Sanatoria, Religious and Benevolent Institutions, and Dispensaries. By Sir Henry Burdett, K.C.B. London: The Scientific Press (Limited). New York: Charles Scribner's Sons.

This monumental work has an indispensable value not only to physicians, but to everyone interested in charitable or philanthropic enterprise. It is so well known that a detailed description of the plan on which it is written is unnecessary; suffice it to say that its pages constitute a complete directory to medical and charitable institutions throughout the world. No efforts are spared to make the information contained within it accurate, and it is thoroughly reliable in every respect. It is hard to estimate the debt of gratitude due to Sir Henry Burdett and his associates, not only from the medical profession, but from the entire world.

In the preface mention is made of the fact that a well-known philanthropist had written to the editors stating how much this work had aided him in the distribution of enormous sums of money among the hospitals of London. This is an indication of the beneficent operations of such a publication. To lawyers and others concerned in the drawing up of wills, bequeathing sums to charities, this work furnishes a reliable guide. Let us sincerely hope that the good work which it has done in the past will be continued in the future.

F. R. P.

THE REFRACTION AND MOTILITY OF THE EYE. FOR STUDENTS AND PRACTITIONERS. By WILLIAM NORWOOD SUTER, M.D., Assistant Surgeon, Episcopal Eye, Ear, and Throat Hospital, Washington, D.C. Illustrated with 101 engravings in the text and 4 plates in colors and monochrome. Philadelphia and New York: Lea Brothers & Co., 1903.

ALL works of this kind must give a certain body of truths. These present little scope for originality. Successful treatment expresses the facts and the reasons upon which they are based in a way comprehensible to the reader, for which the work is intended—in this case students and practitioners of medicine. The most concise and accurate method

of dealing with the optics of refraction is, of course, by mathematics; as this must be largely eschewed, the problem is this: to express mathematical ideas and methods in ordinary language, clear enough for the non-mathematical reader to comprehend. This is never easy, requiring technical knowledge and the teacher's power of exposition in a marked degree, and even then not always possible. We ask, then, when we meet a work of this kind, With what success has the writer solved the problem? In Dr. Suter's book a very high measure of success has been attained. The subject has been so presented that without the sacrifice of accuracy, but a minimum of mathematical knowledge is required of the reader.

In expounding the fundamentals the references are frequently made directly to the works of original experimenters. Interesting historical

uotices abound. Rule of thumb work is conspicuously absent.

Part I. gives the theory of refraction, eight chapters, somewhat less than a third of the entire work. It is less mathematical than the introductory chapter of Landolt, making no references to the formal language of trigonometry.

Part II., two chapters, deals with refraction and motility of the normal eye. Tscherning's theory of the accommodation is given, but

not indorsed.

Parts III. and IV. deal with errors of refraction and disorders of motility. The directions for prescribing correcting lenses in the various forms of ametropia are clear and judicious.

The operative treatment of myopia is very properly stated to be lim-

ited in its application.

Heterophoria is fairly described, tests, symptoms, etc. We are glad to note that the absurd claims which have been made for this condition find no indorsement whatever.

The language of the book is clear and the style direct. T. B. S.

International Clinics. Edited by A. O. J. Kelly, A.M., M.D., Philadelphia, Pa., U. S. A. Vol. I. Thirteenth Series, 1903. Pp. 306. Philadelphia: J. B. Lippincott Co.

In this volume diseases of the circulatory system are well represented by articles by Osler on "Aneurism of the Descending Aorta"—a careful study and more valuable from the collated cases presented in abstract; Wilcox, on "The Treatment of Cardiac and Vascular Fibrosis, Hodgson's Disease, the Treatment of Anæmia, Anæmic and Vascular Murmurs"; Satterthwaite, on "Nauheim Methods in Chronic Heart Disease, with American Adaptations"—a thoroughly practical and scholarly paper, reflecting a large experience. The remaining papers in treatment are those by Finger, who offers the treatment on "Chronic Urethritis," and Fussell, on the "Treatment of Diphtheria," who sees in his title more than the antitoxin question, and gives good advice as to accessory treatment and complications. Medicine is well represented by Billings, with a thoughtful paper on "Primary Intestinal Tuberculosis"; Einhorn takes up "Pyloric Obstruction, Gastric Dilatation, and Gastric Stagnation"; Keen and Senn present a wealth of well-digested surgical information of various topics, among which the

nervous system plays a prominent part—tic douloureux, tranmatic epilepsy, concussion of the brain, and hydrocephalus. Tonnesco, on "The Enduring Results of Total Bilateral Resection of the Cervical Sympathetic in Basedow's Disease," gives his conclusions as follows: "Total bilateral resection of the cervical sympathetic is the most effective means for the relief of primary Basedow's disease. It is, besides, the only rational operation if we concede that this disease is due to functional rather than to organic changes in the system. Cervical sympathectomy is the only operation that relieves the main symptoms of the disease, and at the same time lessens or removes the accessory conditions that have developed during the affection. The effects produced by this operation are such as to bring about complete and lasting relief." Thus, we have the last word from the surgical side of the question, and the medical is quite ready to accept any method which offers hope for a more enduring relief, or indeed cure. Ross, on "Acquired Umbilical Hernia in the Adult," and Manley, on "The Greater Importance of the Organs in Right as compared with those of the Left Lateral Half of the Abdomen," complete the section devoted to surgery. Pediatrics in a single article, Thomson, on "The Causation, Treatment, and Prognosis of Convulsions in Young Children," and Orthopedics, likewise a single, very readable paper, by Shands, on "The Treatment of Weak Feet and Flat Feet," bring the reader to two unusual contributions; that is, King, on "Functional Reversion and its Import in Medical ractice," and Ballantyne, on "The General Principles of Embryology." The remainder of the volume is occupied by a review of the progress of medicine during the year 1902 by Watson and Cattell, in which various topics in medicine, therapeutics, and surgery are taken up. As compared with reviews of progress to be found in the best of the journals or year books this is, of course, limited and incomplete, but as representing that which the reviewers regard as first among the foremost we accept it, and congratulate them upon an excellent fulfilment of their task. We have noted the papers in this volume in more than usual detail, because they present a remarkable degree of excellence and interest. With this volume we recognize the accession of a new editor, who, if he shall maintain the high standard which he has set, will more than meet the expectations of the numerous and critical readers of International Clinics. R. W. W.

THE SURGICAL TREATMENT OF GASTRIC AND DUODENAL ULCERS. By B. G. A. MOYNIHAN, M.S. Lond., F.R.C.S. Eug.; Senior Assistant Surgeon, Leeds General Infirmary; Consulting Surgeon to the Skipton Hospital and to the Mirfield Memorial Hospital, etc. Pp. 83, illustrated. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

The reading matter of this monograph consists of forty pages of text with ten illustrations and diagrams, followed by the histories, in table form, of more than 100 cases submitted to operation. The book is attractive in appearance, printed on good paper in clear type. Mr. Moynihan is to be congratulated on the way he handles his subject, for in clearness, terseness, and brevity his style could not be excelled, and yet,

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at the same time, the reader is never in doubt as to the opinions expressed and the author's idea of the subject under discussion.

The subject-matter is divided under four headings: Perforation of Gastric and Duodenal Ulcers, Hemorrhage, Chronic Ulcer, and Hourglass Stomach. Under these headings the symptoms and treatment are discussed, with special reference to the time for and character of the operation to be performed. He calls attention to the fact that gastric ulcer is seldom single and almost invariably multiple, and for this reason condemns all operations which attempt the extirpation of a given ulcer. reasoning that where many ulcers are present it is impossible to tell which is the offending one. His choice of operation for this reason is almost invariably a gastroenterostomy, and his reasons for preferring this to pyloroplasty are, to the reviewer at least, convincing. Under the subject of Hour-glass Stomach he strongly combats the hypothesis that many of these cases are of congenital origin, believing, and proving this also by his dissections, that such conditions result most frequently from cicatricial contraction of ulcers or from localized inflammatory products outside of the stomach wall. His method of gastroenterostomy is safe, simple, and easy of execution, with the promise of the best after-results. The fact that he has done over eight gastroenterostomies with but one death makes his opinions worthy of the deepest thought, and stamps his method as a thorough and complete one.

This book will be of the greatest value to the abdominal surgeon and also to the practising physician; for to the latter it will be of much assistance in deciding when medical treatment should cease and surgical begin.

R. G. L.

DISEASES OF THE PANCREAS AND THEIR SURGICAL TREATMENT. By A. W. MAYO ROBSON, F.R.C.S., Senior Surgeon, Leeds General Infirmary; Emeritus Professor of Surgery, Yorkshire College, Victoria University; Member of Council and Hunterian Professor, Royal College of Surgeous of England; and B. G. A. MOYNIHAN, M.S. (London), F.R.C.S., Assistant Surgeon, Leeds General Infirmary; Consulting Surgeon to the Skipton Hospital and to the Mirfield Memorial Hospital; Arris and Gale Lecturer and Member of the Board of Examiners in Anatomy for the Fellowship, Royal College of Surgeons of England. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

Until recently little could have been written upon the diagnosis and treatment of pancreatic diseases, but during the past five years, and particularly since the publication of Fitz's paper on "Pancreatitis," in 1899, this subject has received a vast amount of attention both from surgeons and medical men. To the authors of the volume under consideration, and particularly to Robson, is due to a considerable extent the progress made in the surgical treatment of the various pathological conditions of the pancreas. Of course, there is still much to be learned about these conditions, as well as about their treatment, and the aim of the authors has been not to say the last word regarding the pancreas, but rather to present the present status of the subject in as clear a light as possible to the medical profession. It is pleasing to note that they have dedicated this volume "To the Surgeons of America in Cordial Recognition of Their Work."

The first chapter contains the descriptive and surgical anatomy of the pancreas, and the second deals with the experimental work which has been done on the pancreas, particularly regarding the relation of diabetes to diseases of the pancreas. The chapter on Injuries of the Pancreas is interesting, a number of cases having been gathered from the literature illustrating lacerations and other injuries. In none of the recorded cases was it possible to make a diagnosis of laceration of the pancreas before operation or death. Injury of the organ is seldom unaccompanied by extensive injury to other abdominal viscera, and consequently treatment of the condition is rarely possible. As a result of laceration of the pancreas, however, certain sequelæ may occur, such as absence of the pancreas or distention of the lesser peritoneal cavity due to the pouring out of blood and possibly pancreatic secretion. The author states that there have been eight well-investigated cases of prolapse of the pancreas.

Four chapters are devoted to the various forms of pancreatitis, and it is this condition which appeals most to both physician and surgeon. Pancreatitis is divided into acute, subacute, and chronic. The authors show that the pancreatic ducts participate in the same inflammatory processes as do the bile-ducts. They state that "the most satisfactory evidence at present of deficient pancreatic juice in the bowel is afforded by the abundance of undigested muscle fibre in the motions of a patient not suffering from diarrhæa after a meat diet; and by the absence of carbolic acid and salicin in the urine when 60 grains of salol are taken in divided doses during the day." The study of pancreatitis under the clinical heads of acute, subacute, and chronic, does not interfere with Fitz's pathological classification of acute pancreatitis into hemorrhagic, suppurative, and gangrenous. Both the symptoms and pathology of the various forms of pancreatitis are well illustrated by the reports of a number of interesting cases.

The closing chapters deal with pancreatic calculi, cysts, and new-

growths.

This work has been well prepared by thoroughly competent authorities, and undoubtedly presents the subject in a most useful manner to both surgeons and physicians.

J. H. G.

DISEASES OF THE SKIN. A MANUAL FOR STUDENTS AND PRACTITIONERS. By JOSEPH GRINDON, Ph.B., M.D., Professor of Clinical Dermatology and Syphilis, Washington University; Dermatologist to the O'Fallon Dispensary, St. Louis Mullanphy Hospital, St. Luke's Hospital, etc. Philadelphia and New York: Lea Brothers & Co., 1902.

This manual of nearly 400 pages—one of a series of "pocket text-books"—stands midway between the quiz compend and the more formal and elaborate treatises. It aims to present the essentials of Dermatology in a concise manner, and is intended, as we learn from the preface, not only for the student, but for the practitioner of medicine. The symptomatology, pathology, and treatment of the various diseases of the skin are discussed in a clear and, for the most part, satisfactory manner, although, necessarily, with brevity.

The author regards pityriasis rubra and dermatitis exfoliativa as simply varieties of the same affection. We do not believe, however, that the grave and often fatal malady described by Hebra under the former title is the same as the exfoliative inflammation of the skin which not infrequently appears as the sequel of other inflammatory diseases, such as psoriasis, and pursues a uniformly benign course.

Eczema is looked upon as a symptom-complex rather than a distinct disease, a manner of view which seems to find favor with recent writers. In considering the predisposing causes of this Protean disease the author is inclined to accept the existence of the so-called dartrous diathesis of the older French writers. Since no one, not even the French themselves, has ever been able to explain, satisfactorily, what is meant exactly by dartre, it hardly seems worth while to resurrect this ancient notion. Renal incompetence is stated to be an important factor in the causation of eczema in those past middle life. It would seem as if this ought to be true, but, as a matter of fact, no one has yet been able to demonstrate any definite relation between insufficient urinary excretion and eczema. Even in such an affection as chronic interstitial nephritis, in which renal incompetence may reach an extreme degree, eczema is decidedly the exception rather than the rule.

In the treatment of erythematous lupus the author urges that care be taken that the remedies used shall do no harm, even if they do no good—a much-needed caution, since the inexperienced are apt to make bad worse by injudicious and too active treatment. We do not find any mention made of large doses of quinine internally in the treatment of this very obstinate affection—a remedy which recent observation has

shown to be of decided benefit in many cases.

Although necessarily lacking in detail because of its size, the manual will be found a useful one by both student and practitioner. M. B. H.

THE ROENTGEN RAYS IN THERAPEUTICS AND DIAGNOSIS. By W. A. PUSEY, A.M., M.D., of Chicago, and E. W. CALDWELL, B.S., of New York. Philadelphia, New York, and London: W. B. Saunders & Co., 1903.

In this work the authors have presented clearly and simply their opinions derived from comparative study and their personal clinical and laboratory experience. Sufficient has been taken from the literature of the subject to afford the reader a comprehensive view of the influences which have led them to form the personal opinions expressed, the citation of the journals and authorities permitting the reader to follow such other opinions as he fancies further. Without any desire to be dogmatic they present a comprehensive work, based upon their personal experience, that will enable the reader to acquire by clinical study the knowledge which is essential to the proper employment of this method of diagnosis.

Part I. X-ray Apparatus and its Uses in Diagnosis. Without entering too much into electrical detail, the authors have given the results of their personal experience as trained electricians in adapting apparatus to the diagnostic needs of the surgeon. As is to be expected this por-

tion of the work is richer in electrical technique and methods than in the surgical interpretation of the results that are obtained. It deals with the question of apparatus, etc., with an appreciation of the needs of the surgeon, and is, therefore, of great value, since things electrical are

explained clearly in language the surgeon can understand.

Part II. The Therapeutic Application of X-rays. After a comprehensive résumé of the literature of the subject the authors give valuable illustrations of its application culled from their personal experience. The chapter on the Effects of X-rays on Tissue is particularly valuable in teaching the novice what to expect as therapeutic manifestations when commencing treatment. In describing their technique they have fully realized the impossibility of dealing with any other technique than their own, and make the reader realize that their deductions apply only to their own method, and that clinical experience is the only foundation as yet upon which each worker must build his own method in therapeutics. This element of personal clinical experience cannot be dwelt upon too strongly. No matter how explicit and valuable the work or the instruction the novice has received, he should fully realize that he is always dealing with a powerful agent that is capable of doing harm as well as good, and must often be used with its utmost power to attain the desired results. A study of this work will show why the expert with this method can obtain results that are impossible to the novice, and will lead to the careful instruction of those asked to take up this work by hospitals before they are placed in

The work will be an inspiration to the student to the scientific study

of the X-rays, as well as a ready guide and book of reference.

C. L. L.

Tuberculosis. Recast from Lectures delivered at Rush Medical College, in Affiliation with the University of Chicago. By Norman Bridge, A.M., M.D. Philadelphia, New York, and London: W. B. Saunders & Co.

It is not an easy task to write interestingly on a well-worn topic like tuberculosis, yet it is in these very subjects that an original contribution is particularly welcome. While there have been no material additions to our knowledge of pulmonary tuberculosis within recent years, the interest in the disease on the part of the public as well as the profession has never been keener than at the present time, since the vital importance of effective precautionary measures and of rational methods of treatment has come to be appreciated even by our municipal authorities. It is needless to dwell on the author's presentation of the pathology, bacteriology, and other formal parts of the work except in general approbation of his treatment of these subjects. The chief interest of the book lies in the personal element and spontancity that is or should be the characteristic of clinical teaching: a general acquaintance with the fundamentals of tuberculous lore—the author has defined the meanings of these much misused terms, tuberculous and tubercular—on the part of his readers or, rather, his hearers.

He distinguishes no less than eight clinical forms of pulmonary tuberculosis, and it must be confessed that some of these distinctions are rather finely drawn, although always instructive, and there is, unfortunately, no hint of the relative frequency of each. With four of these the student will be familiar from his text-book reading, the fibrous form, or "fibroid phthisis"; the circumscribed form, with a distinctly localized lesion, walled off by a fibrous wall, without general spread; the form characterized by cavities, pus absorption, and an overpowering mixed infection terminating in death before there has been time for extension to other organs—so-called "galloping consumption"; and general visceral tuberculosis secondary to a pulmonary atrium. The last member of the group, to which the author would concede the name of "miliary tuberculosis," is described as a pure tuberculous infection, either primary or secondary to a "long-existing quiescent tuberculosis in a circumscribed lung area," distinctly chronic in character, with almost no pus formation, and "only a little fever, which may occur irregularly," and uncertain physical signs. It will be seen that the author's teaching in this respect differs radically from accepted dogmas; indeed, he specifically attacks the conception of miliary tuberculosis as given in text-books, denies the occurrence of high fever in tuberculosis except as a terminal complication, and regards this form as a chronic condition with a stormy ending. The remaining three varieties are described as tuberculosis probably confined to the bronchial mucous membrane, with the most favorable prognosis of all; a "fibrous and dissolving" form with atrophy of septa from pressure on the capillaries, coalescence of contiguous alveoli, and consequent reduction of respiratory space, characterized by resonance instead of dulness and other paradoxical physical signs—a steadily progressive form going on to an inevitable lethal termination; and a form which must surely be rare and in which the infection begins in the right apex, and after complete regression attacks the upper portion of the left lung, with or without recrudescence of the morbid process at the original site, depending on the duration of life.

The chapters on diagnosis contain a number of practical points and warnings against possible errors in observation and interpretation, which

are evidently the outcome of the author's personal experience.

Nearly one-half of the little volume is devoted to prophylaxis and treatment, and while, of course, climatic and hygienic methods come in for their full share of attention, the author shows that much can be done in a palliative as well as in a curative way without expatriating the patient. Directions as to personal hygiene and diet are dwelt with at length. In the matter of serumtherapy the author, like most other authorities, is extremely skeptical.

R. M. G.

THE INTERNATIONAL MEDICAL ANNUAL. A Year Book of Treatment and Practitioner's Index. New York: E. B. Treat & Co., 1903.

This most excellent compendium of the year's work in the medical profession is worthy of high commendation. It is difficult for the compilers of such a book to introduce any very original features, but the editors of the volume under consideration have shown much discretion in the arrangement of their work and in the material which they have abstracted in it. A particularly attractive feature of the volume is the

excellence and large number of the illustrations, many of them in colors. For the practitioner who wishes a handy book in which to look up recent points in medicine we can recommend this as a most useful guide.

THE DISEASES OF WARM COUNTRIES: A HANDBOOK FOR MEDICAL MEN. By B. SCHEUBE, State Physician and Sanitary Adviser, Greiz; late Professor at the Medical School in Kyoto (Japan). Translated from the German by Pauline Falcke, with addenda on Yellow Fever by James Cantlie, M.B., F.R.C.S., and on Malaria by C. W. Daniels, M.B., M.R.C.S. Edited by James Cantlie, Lecturer at the London School of Tropical Medicine, etc. Second revised edition. Philadelphia: P. Blakiston's Son & Co., 1903.

It is a matter of congratulation that the well-known and authoritative work of Professor Scheube on tropical diseases has been translated into English. The growing importance of a knowledge of tropical disease to American physicians makes the volume peculiarly welcome. The benefit to English medical literature is, moreover, enhanced by the consideration that to a sufficient and discriminating presentation of the knowledge of tropical diseases is added a wide experience in the treatment of many of the diseases dealt with in Professor Schcube's volume. The scope of the volume may be gathered from the several sections into which the matter is divided. The first section deals with the general infections, among which beriberi and dengue, diseases of unknown etiology, are placed alongside of plague and leprosy. What will impress the physician whose experience has been limited to temperate climates, where disease has perhaps been more carefully studied and differentiated, is the use of such terms as "Indian Nasha fever" and "Japanese River or flood fever" to designate disease entities. The first, described by Fernandez, abounds in malarial districts, but is doubtfully due to the Plasmodium malariæ; it is, moreover, of very doubtful specificity. The second, described by Balz, and regarded by him as specific in nature, is of unknown etiology, although the "virus" is supposed to cling to the submerged soil of the river valleys. The constancy of a skin eruption appearing on the sixth or seventh day brings it among the exanthemata. The mortality is given variously from 15 to 70 per eent. The second section treats of the diseases due to intoxicants, among which are pellagra, laequer poisoning, venom poisonings, etc. It may be worth while to allude to lacquer poisoning on account of the resemblance to rhus poisoning. Only the fresh lacquer produces the general symptoms and skin lesions, which consist of slight fever and itching of the skin of the head, face, and limbs, to be followed by ædema and a papular eruption. This resemblance of symptoms to those of Rhus toxicodendron poisoning is emphasized by the fact that the lacquer-tree belongs to the same botanical family, its species being Rhus verniciferæ. The third section deals with animal parasites, a most important chapter of tropical disease, the fourth of the organic diseases, among which sprue, dysentery, and sleeping sickness are included. There seems little justification for the inclusion of dysentery in this section and its treatment as a disease of wholly unknown etiology. It would have been far better to have substituted some more distinctive title for that of "organic" diseases, and in view of the fact that the diseases of the group are doubtless infectious in origin, "special infections" might have been a suitable one. It is to be regretted that no reference in the article on dysentery is made to the studies of Shiga and his followers that have added so greatly to our knowledge of the cause of dysentery.

Section five treats of the cutaneous and local diseases, among which Madura foot, tinea imbricata, and pinta (mal del pinto), a dermatomycosis, distinguished by spots of different colors, which give to the victims a piebald appearance without causing any disturbance of the

general health.

The last section is devoted to a consideration of the cosmopolitan diseases of the tropics, by which is meant the diseases which are common

in temperate climates as well.

This work, in itself so important, is increased in value by the addition of a brief chapter on "Malaria," by Dr. Daniels, and on "Yellow Fever," by Dr. Cantlie, and by the many new plates introduced into the translation.

DIE ROENTGENSTRAHLEN IM DIENSTE DER CHIRURGIE. By Dr. CARL BECK, of New York. Published by Seitz & Schauer, Munchen.

The work consists of two volumes written in the German language. Volume I. contains 138 pages, and is devoted to the uses for which the Roentgen rays may be applied in medicine and surgery. The author lays stress upon the value of this method of diagnosis, and takes up systematically the different parts of the body, mentioning the pathological conditions that may occur in each part. He gives very briefly an idea of the technique used in the examination of each part of the body, and in a number of instances illustrates with brief reports of cases.

Volume II. consists of sixty plates, which, with a few exceptions, seem

As a whole, the work presents little that is new, unless it be in the use of the Roentgen ray in the diagnosis of billiary calculi. It is not a work for a beginner, but may be added with profit to a skiagrapher's library.

G. E. P.

THE ROENTGEN RAYS IN MEDICINE AND SURGERY. By FRANCIS H. WILLIAMS, M.D., of Boston. Third edition. New York: The Macmillan Company, 1903.

In this new and enlarged edition Dr. Williams has added much of value both by the increased data derived from his personal experience and by a well-indexed résumé of the current literature of the subject. This feature of the work is particularly valuable, as the student is enabled to turn to the original writing of the authority quoted, in any line of work in which he is particularly interested.

C. L. L.

PROGRESS

OF

MEDICAL SCIENCE.

MEDICINE.

UNDER THE CHARGE OF

WILLIAM OSLER, M.D.,

PROFESSOR OF MEDICINE IN THE JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND,

AND

W. S. THAYER, M.D.,

ASSOCIATE PROFESSOR OF MEDICINE IN JOHNS HOPKINS UNIVERSITY, BALTIMORE, MARYLAND.

The Operative Treatment of Ulcerative Colitis.—Boas (Doutsche med. Wochenschrift, 1903, xxix., 196) reports an interesting case of ulcerative colitis cured by operative interference and irrigation of the colon. The patient, aged twenty-eight years, had suffered with chronic diarrhoa for five years, the dejecta containing blood and pus. There was slight tenderness along the course of the colon; the rectum was free from trouble. No amœbæ wcre found in the stools. Despite careful diet and irrigations there was no essential improvement. In March, 1901, a fecal fistula was made by Steiner. The small intestine was found to be normal in appearance. The serosa of the colon, however, as far as could be examined, showed spots of thickening in various places. After the operation the feces for a time appeared both through the fistula and per rectum, but after several weeks the rectal movements entirely ceased. Irrigations daily, and then every other day, with solutions of nitrate of silver, and later with iodine, were given. ment was steady, but slow. Constant examinations of the centrifugalized sediment of the irrigating fluid were made, and as late as seven months after the operation a reaction for blood was found, as well as Charcot-Leyden crystals. When, finally, a year after the operation, all these abnormal substances had disappeared, the fecal fistula was closed. Nine months later the patient remained entirely well excepting for slight constipation.

The Complications and Sequelæ of Pertussis.—Robertson (Scottish Medical and Surgical Journal, June, 1903, p. 485) discusses at considerable length the complications and sequelæ of whooping-cough, showing that this is not such an innocent discase as it is generally held to be. Of the pulmonary complications, bronchopneumonia is probably the commonest. Em-

physema, of the alveolar type, is almost invariably present to a slight degree. It may, however, be of the interstitial type, involving the mediastinal tissues and spreading to the cellular tissues of the neck, and eventually infiltrating the subcutaueous tissue of the whole body. Pneumothorax from rupture of distended alveoli has occurred. Owing to weakening of the bronchial walls bronchiectasis has resulted.

The nervous complications are varied and not infrequently rather serious. Convulsions are the most frequent, and usually occur during a spasmodic Whereas these are usually believed to be due to cerebral congestion, Robertson is rather inclined to think that they are due to the degree of extreme nerve irritability induced by the action of the specific toxins on the nerve cells of the motor cortex. The paralyses that occur are of great interest and are not rare. They may come on during the spasmodic stage or in convalescence. That some of these, occurring in the acute stages of the disease, are due to submeningeal hemorrhages has been demonstrated by autopsy. Those occurring in convalescence are probably the result of the effect of the toxins on the bloodyessels or nerve cells. The hemiplegias which occur may be due either to submeningeal or intraccrebral hemorrhage. Thrombosis of the cerebral vessels has been described. Valentine has analyzed 83 cases of paralysis occurring after pertussis. Of these 62, or 74.6 per cent., were of cerebral origin. Of the cerebral cases 40 were cases of hemiplegia (21 were right-sided, 15 left-sided, and in 4 the side was not mentioned); 16 were cases of monoplegia affecting the function of the arm, face, or leg. or of speech or sight: the remainder were paraplegias. prognosis was not very good, as only about 40 per cent. of the paralyses were recovered from. Alexander Bruce reported two cases of spastic paraplegia following whooping-cough, and Foggie has recently recorded a case where cerebral diplegia followed the disease. Localized paralyses, involving various of the cerebral nerves, may occur. Möbius has described a case of ascending paralysis of the spinal cord following pertussis in a child aged three

Of the circulatory disturbances dilatation of the heart is the most frequent and serious. If there be any previous weakness of the heart muscle, it may be the cause of a fatal result.

Kuight found albuminuria in 66 out of 86 cases examined. It is usually present in mere traces. In about one-fifth of the cases of albuminuria blood cells are present, and in a few hyaline casts are also found. Non-diabetic glycosuria is not an infrequent accompaniment, especially in the cases accompanied by convulsions.

Transient loss of vision is said by the writer to be a frequent complication. In most cases this is due to a disturbance of the cerebral circulation, but it may be due to a retinal hemorrhage. Subconjunctival hemorrhages are common. Strabismus, both temporary or permanent, may occur. The membrana tympani has been ruptured during an attack of coughing.

Some Points on Metabolism in Gout, with Special Reference to the Relationship between the Uric Acid and Phosphoric Acid Elimination in the Intervals and during Acute Attacks.—FUTCHER (*The Practitioner*, August, 1903, p. 181) points out that there is some theoretical basis for the

opinion that there might be a parallel relationship between the uric acid and phosphoric acid excretion in gout. Both are products of the disintegration of nuclein. Nuclein breaks up into albumin and nucleinic acid. Nucleinic acid further disintegrates into phosphoric acid and a so-called "mother substance." This "mother substance" yields both xanthin bases and uric acid, the amount of each depending upon the conditions favoring oxidation.

The excretion of uric acid and phosphoric acid was followed in a number of gout cases during the acute attacks and in the intervals. The investigation seemed to show a close parallel relationship between the two. In the quiescent intervals both were markedly below normal. Two or three days after the acute arthritic symptoms commence the phosphoric acid and uric acid gradually increase until they reach the average normal output, or even the upper limit for normal. As the acute manifestations subside, both steadily fall and remain below the lower limit for normal until the onset of the next acute attack. The investigation pointed strongly in favor of the view that both are products of nuclein disintegration.

The Diet in Nephritis.—Koester, of Gothenburg (Nord. medizin. Archiv Jarg., 1903, Abt. II., Anhang, 138), has carefully studied a number of patients with different forms of nephritis under four different diet régimes, which were varied from time to time with each patient. These diets were (1) an exclusively milk diet, one and a half litres a day; (2) milk and vegetable diet; (3) white meat and eggs; (4) ordinary mixed diet.

The results of his observations the author shows in instructive tables. The following conclusions were reached:

- 1. In acute nephritis a strict milk diet is indicated, and only after the disappearance of the acute process should this be changed.
 - 2. The same holds for acute exacerbations in chronic nephritis.
- 3. It is best to begin the treatment of a chronic nephritis with a strict milk or milk and vegetable diet. When, however, the excretion of albumin during this treatment becomes for some time constant in quantity, then the patient may without danger be allowed a more mixed diet, even with meat of any kind.
- 4. Œdema and ascites are no contraindications to a mixed diet if the patients desire it.
- 5. It is a matter of indifference whether the patient be given red or white meat. Alcoholic liquors and condiments are contraindicated. It is often of advantage, after a diet containing meat has been continued for some time, to order for a short time a strict milk diet. During this treatment a diminution in the excretion of albumin may come about, which later continues.

In the discussion Asser, of Christiania, agreed with Koester that a strict milk diet in chronic nephritis was not only unnecessary, but might be even dangerous. He had seen patients improve when a milk diet was changed for a mixed diet. Even in acute nephritis, after scarlet fever and diphtheria, the author believed that sometimes a mixed diet, consisting in the main of milk, bread and butter, and fish, was of advantage. Sometimes in mild cases a little meat even is allowed. In none of his cases in which this diet

had been allowed had uræmia come on, while he had often seen this occur under an exclusively milk diet. Our knowledge concerning the effect of the diet in nephritis is very slight.

Laache, of Christiania, agreed entirely with the conclusions of Koester. One should not be too strict in the diet in chronic conditions. There are cases of individuals with chronic albuminuria who lie in bed of their own accord for weeks and months on a strict milk diet; but, though the albumin may sometimes disappear, it usually soon returns at the end of the treatment. In acute nephritis, however, he believes that it is unwise to deviate from the generally accepted diet, namely, one consisting mainly of milk, together with easily digested carbohydrates.

Siven. of Helsingfors, calls attention to the fact that, recognizing that the final product of the digestion of albumins-in the main, urea-is excreted through the kidneys, while those of the cholehydrates and fats are excreted mainly through the lungs and skin, we seek to give a diet which contains as little albuminoid material as possible. A milk diet is, however, scarcely rational, inasmuch as the quantity of milk sufficient for the nourishment of an adult (three to four litres a day) contains 105 to 140 grammes of albumin. or as much as an ordinary man takes daily in his usual diet. One would then scarcely expect a better result from a milk diet than from an ordinary mixed diet, a fact which appears to be demonstrated by Koester's interesting investigation. The main difference between a milk diet and the ordinary diet is that the latter contains a mass of extractives (purin bodies, etc.), concerning the influence of which upon the kidneys but little is known. He is inclined to believe that the fears of possible harm from a diet containing a minimum amount of albumin are exaggerated, and believes that it would be practical and advisable to test the effect on nephritis of a dict consisting solcly of carbohydrates and fats.

The Discovery of the Cause of Sleeping Sickness .- An extremely important discovery has been made by CASTELLANI, of Florence (Lancet, London, 1903, vol. ii. p. 1735), who, while engaged in a study of the problematical sleeping sickness of Africa, has found in the cerebrospinal fluid of cases of this disease, obtained by lumbar puncture, living trypanosomes. are not found in large numbers, and it is necessary to draw off at least 15 e.cm. of the cerebrospinal fluid. "It is better to reject the first few cubic centimetres, as they are apt to contain blood." As soon as the fluid becomes clear 10 c.cm. arc collected, and after centrifugalization there is found at the bottom a slight whitish sediment and in some cases a minute trace of blood. If the liquid above the sediment be poured off, a moderately low power of the microscope reveals the trypanosomes. These have been found during life in twenty out of thirty-four cases of sleeping sickness. On two occasions they were also found in fluid from the lateral ventricles, and in one instance in the blood. The author does not believe that the trypanosomes result from the admixture of blood, as in cases where no trace of blood was found the trypanosomes have also been present. In twelve cases of other disease the cerebrospinal fluid was free from these organisms, although several of the cases were instances of ordinary trypanosoma fever, cases which have no clinical similarity with sleeping sickness. The organisms found differ, as far as the author has been able to observe, in no way from the species found

in the blood of trypanosoma fever—T. gambieuse (Dutton)—though, as a rule, the micronucleus lies nearer the extremity, and the vacuole is apparently larger. In post-mortem examinations of 80 per cent. of the cases where the trypanosoma was found during life, the author cultivated from the blood of the heart and from the liquid of the lateral ventricles a streptococcus which he has already described. He believes that this represents a terminal infection.

As a note to this article the Secretary of the Royal Society, Prof. Foster, states that Bruce, who is now continuing these observations, has found the trypanosoma in the spinal fluid in every one of thirty-eight cases of sleeping sickness, and in the blood of twelve out of thirteen cases.

The Contagiousness of Scarlet Fever.—The old idea that contagion in scarlet fever is chiefly conveyed by the exfoliating skin has of recent years been brought into considerable doubt. Most interesting observations on this point are communicated by AASER, of Christiania (Nord. med. Arch., 1903, Abt. II., Anhang 51). From 1895 up to June, 1902, Aaser had under his care 3800 eases of searlet fever, 79 of which obtained their infection from patients who had been discharged from the hospital as well and were supposed to be free from the contagium. The average length of time during which these individuals had been under hospital treatment was nine weeks. The patients were all most carefully washed and disinfected, and the boys' heads were all shaved and scrubbed before discharge. Of these patients 40 were boys and 39 girls, so that sex apparently played no important rôle. That the hair played no part in conveying the infection would apparently be shown by the relation between the number of boys and girls in this group of cases. In 38 per cent. desquamation had entirely ceased one week before discharge, and in the rest from one and a half to four or five weeks. The author believes that too much weight had been laid upon the importance of desquamating epithelium, asserting that in many instances children freely desquamating have failed to convey the disease to susceptible individuals. He is convinced, at all events, that in these eases the transmission of the disease could not be ascribed to desquamation. On earcful analysis of his observations, however, the result of which is shown in an excellent table, he has become convinced that the main source of infection was the presence of some local affection of the throat, nose, or ear, associated with discharge. In conclusion he says: "My observations show that some patients with searlet fever may remain sources of contagion for a time far behind the usually recognized period. They show, further, that the termination of desquamation is of itself no criterion as to how long contagiousness remains. The poison can apparently remain for a considerable length of time in the nose, throat, and middle ear. Through the sceretion from these mucons membranes the poison is further distributed. In this secretion, then, lies the danger of infection.

"As long as there is an abnormal sceretion the patient must, therefore, remain isolated, even if the period be twice as long as is ordinarily regarded as necessary, and the patient with searlet fever should never be discharged until the physician has convinced himself by careful examination of the throat and nose (anterior and posterior rhinoscopy) that the secretion had ceased."

SURGERY.

UNDER THE CHARGE OF

J. WILLIAM WHITE, M.D.,

JOHN BHEA BARTON PROFESSOR OF SURGERY IN THE UNIVERSITY OF PENNSYLVANIA; SURGEON TO THE UNIVERSITY HOSPITAL.

AND

F. D. PATTERSON, M.D..

SURGEON TO THE X-RAY DEPARTMENT OF THE HOWARD HOSPITAL; CLINICAL ASSISTANT TO THE

Multiple Chancres.—PIERRON (Archives de méd. et de pharmacie militaires, No. 2, 1903) reports the interesting case of a man who presented himself for treatment with six distinct and separate chancres on the penis. The secondaries were slight and the severity of the case seemed in no way to be proportionate to the number of the chancres, and the disease ran a mild course and responded favorably to specific treatment.

Three Successful Laparotomies for Intestinal Perforation in Typhoid Fever -- HARTE (Annals of Surgery, July, 1903), after reporting three successful cases, states that the keynote of success in dealing successfully with this condition is the early recognition of the lesion. At the best this is a most difficult procedure and the diagnosis can best be made by the medical attendant who has carefully followed the case from the beginning, noticing all the trifling changes that occur in the abdomen. When any undue symptom arises the surgeon should be immediately consulted. The classic symptoms of perforation, when well marked, can hardly be mistaken-such as pain, tenderness, rigidity, shock, chill, facial expression, and all the symptoms of peritonitis. Muscular rigidity is one of the earliest and most important signs of intraperitoneal irritation. The leukocyte count has proved of very little value at the time when most needed. Immediate operation should be urged even in the presence of profound shock, as every hour of delay proportionately decreases the chances of recovery. In 332 reported cases a median incision was made in 96, with a mortality of 78.12 per cent.; in 123 cases a right lateral incision was made, with a mortality of 68.37 per cent., while in the other cases operated upon the site of the incision was not mentioned. When the perforation has been found, and its closure will not produce too great stenosis of the bowel, it should be rapidly closed with silk sutures in whichever direction, either transversely or longitudinally, to the lumen of the bowel which produces the least narrowing of the gut. No time should be wasted in attempting to trim or freshen the edges of the ulcer. stitch is the so-called mattress suture, as a running Lembert is apt to cut or tear through the friable tissues. When the opening is closed the bowel should be carefully inspected for other perforations, as not infrequently these openings are multiple. Often dark necrotic spots are found where the ulcer has destroyed the coats of the bowcl down to the peritoneum. These

should be treated just as though a perforation had taken place and the weakened area fortified by being folded in with stitches.

When closure is not practicable by means of the opening being too large or the area of inflammation too great, one has the choice of four procedures: (1) A plug of omentum may be fashioned and stitched against the opening in the bowel so as to form a simple patch, after the manner in which nature sometimes deals with these conditions. (2) Resection of the bowel and an end-to-end anastomosis either with stitches or a Murphy button, the latter being much more rapid. (3) The formation of an artificial anus by stitching the bowel to the abdominal wall, and (4) cutting off the damaged area of the bowel from the general peritoneal cavity by carefully placing pieces of gauze between the folds of the bowel. The peritoneal cavity should be thoroughly cleansed with salt solutions and ample provision made for drainage. or no attempt should be made to close the abdominal wound. In conclusion the author states that there are two important factors to be carefully considered. First, the early recognition of the lesion and dealing with it as rapidly as possible, in order that as little time as possible will elapse from the time of perforation until operation has been performed; and, second, that the operation should be so planned, since time is so important an element, that not a moment should be wasted during it, the technique being of the simplest character, as every moment of delay will cause a much higher percentage of mortality.

THERAPEUTICS.

UNDER THE CHARGE OF

REYNOLD WEBB WILCOX, M.D., LL.D.,

PROFESSOR OF MEDICINE AND THERAPEUTICS AT THE NEW YORK POST-GRADUATE MEDICAL SCHOOL AND HOSPITAL; VISITING PHYSICIAN TO ST. MARK'S HOSPITAL,

AND

SMITH ELY JELLIFFE, M.D., PH.D.,

PROFESSOR OF PHARMACOGNOSY AT THE COLLEGE OF PHARMACY; INSTRUCTOR IN MATERIA MEDICA AND THERAPEUTICS (COLUMBIA UNIVERSITY), NEW YORK.

Diet in Gout.—Sir Dyce Duckworth (Practitioner, July, 1903) says that with regard to animal food generally, it is not only harmless, but beneficial to gouty persons provided it be taken in moderation. The alleged difference between red and white meats he regards as nonsense. Tender mutton is, of course, more digestible than tough beef. He recognizes no differences between red and white meats and fowl and any variety of game in regard to gout-provoking qualities, provided the quantity consumed is restricted and the cooking is plain and appropriate. Fish is one of the best articles of diet for the gouty. Lobsters, oysters, and most shell-fish are quite innocuous provided they are eaten fresh. No viscera, such as heart, liver, sweetbreads, etc., need be excluded from the diet.

With reference to vegetable food, ordinary bread, plain or toasted, or plain biscuits, are, of course, permissible. He finds it hard to understand why potatoes should have ever been forbidden; plainly cooked, they are quite harmless. The assertion that roots and vegetables grown underground are harmful he says is rubbish, and fruit is condemned on very inadequate grounds. Most gouty persons can take fruit cooked or raw in moderation. not only with impunity, but with benefit. Tea, coffee, and cocoa are quite harmless. Sugar taken in moderation is not only harmless, but beneficial. Wines and alcoholic liquors require much discrimination. Many gouty persons are best without any, but the fact remains that many others are better for the use of a little good wine taken with one meal in the day. There can be no universal rule as to kind or amount. Most varieties of malt liquors are harmful to the majority of gouty patients, but in summer many persons can take small quantities of the lighter varieties, such as beer, with impunity and benefit. Well-prepared cider is an excellent drink in warm weather for gouty patients, but the quantity should not exceed a pint. He lays great stress on individualizing in cases of gout, and says that curtailing the food and sending patients away to spas is generally harmful.

Treatment of Gout.—Dr. Arthur P. Luff (Practitioner, July, 1903) says that gout is a disease that is due to faulty metabolism, probably both intestinal and hepatic, as a result of which certain poisons ("possibly the purins and other bodies, but of which we at present know but very little, lead to autointoxication, which is an early factor in the development of the gouty condition"). He thinks that with increasing knowledge and experience of the disease uric acid and its salts will in all probability have to be relegated to a position of subsidiary importance in the pathogenesis of gout. The joint manifestations are probably dependent upon much more general and much larger conditions than a mere excess of uric acid in the blood. The deposition of sodium biurate is possibly merely the sign of the disease, not the essence of it.

As regards the treatment of gout, he said that it should be borne in mind that no routine line can be laid down that can be adopted snitably to all cases. Individualism—the treatment of the patient rather than the disease—is the prime feature. The treatment of gout, in his mind, should have for its aim the following objects:

(1) The treatment of the gouty paroxysm in cases of acute gout, and the relief of pain as speedily as possible; (2) the treatment of the subacute or chronic condition and the prevention of the recurrence of an attack, which may be effected by the promotion of the elimination of the uric acid and the other purin bodies, by checking any excessive formation of these bodies that occurs in some subjects, and by careful attention to diet and general hygiene; and (3) the treatment of the affected joint or joints with the object of removing the nratic deposits and of preventing permanent deformity. For the treatment of the gouty paroxysm the limb should be placed in the horizontal position, or slightly elevated above the level of the body, and a cradle should be arranged so as to take the weight of the bed-clothes off the affected part. To alleviate the severe pain felt in the affected joint warm-packs should be arranged around it, consisting of cotton-wool saturated with a soothing

lotion, and then lightly covered with oiled silk. He has found the following lotion most useful in relieving the local pain:

R.—Sodii carb.	•	•	•	•	•		ξiν.
Linim, belladonnæ							Зij.
Tinct. opii	•						ãiss.
Aq						ad	₹viij.

A small portion of the lotion should be mixed with an equal quantity of water, and then poured on the cotton-wool previously arranged around the joint. The pack should be changed every four hours. In connection with the acute paroxysm no attempt at local depletion—such as the application of leeches to the inflamed joint, blistering, or incisions—should on any account be made, owing to the liability of thereby extending the inflammatory condition, and so producing subsequent ankylosis or deformity.

For the internal treatment of acute gout colchicum is one of the most valuable of drugs. It should be especially used for acute gout and for subacute attacks supervening on chronic gout. If it be used continuously, tolerance is apt to be acquired, and the drug ceases to act. At the commencement a large dose of 30 or 40 minims of the wine with from 40 to 60 grains of citrate of potassium should be administered three times a day. The citrate of potassium, which is given for its combined properties of acting as a diuretic and of diminishing the acidity of the urine, may, if desired, be given as an effervescing mixture, using 30 grains of potassium bicarbonate to 20 grains of citric acid. Colchicum reduces the gouty inflammation, relieves the pain, and shortens the attack. It should only be taken under medical advice, and should never be given in such doses as to produce extreme depression. After the inflammation of an acute attack has subsided the doses of colchicum should be diminished until it is left off. From 3 to 4 grains of "blue pills" should be given the first night, followed by a dose of Epsom salts in the morning. Mercury should be given only in sufficient doses to produce its cholagogue effect, as owing to the possibly defective action of the kidneys the mercury absorbed into the general system may be eliminated with great difficulty. In his opinion it is advisable in the treatment of gouty patients in the acute or subacute stages to avoid the use of saline purgatives owing their efficacy to salts of sodium, on account of the power possessed by all sodium salts of diminishing the solubility of sodium biurate. In the employment of purgatives for gouty patients the great object is not to produce powerful purgation, but to relieve portal congestion, since a congested condition of the liver means that excessive quantities of glycogen and purin bodies remain in the circulation, with the consequent production of an excessive quantity of uric acid. A pill containing either 2 grains of euonymin or 1 of a grain of podophyllin, combined with 1 grain of extract of hyoscyamus and 1½ grains of the compound extract of colocynth, will in many cases be found to he very useful.

If the pain of an acute attack of gout is so severe as to prevent sleep, chloral, sulphonal, or trional may be given, or a full dose of extract of hyoscyanus given with blue pill at night will in some cases act as a very useful anodyne. The administration of opium or morphine should, if possible, be avoided, owing to the risk of its deficient elimination, and also on

account of its diminishing the amount of urine, and its tendency to derange digestion and check hepatic metabolism.

The means of checking the excessive formation of the purin bodies consist in careful attention to diet and regimen, in the production of the metabolism of the liver, so as to check the excessive production of the antecedents of uric acid, and in the relief of congestion of the portal system, which can be effected by keeping the bowels open at least once a day. In addition to colchicum, which may be given in small doses, guaiacum may very usefully be administered as an alterative, which stimulates the metabolism of the liver and also affords relief to the portal system. From 5 to 10 grains of guaiacum resin should be given in cachets two or three times a day, according to the effect on the bowels, since guaiacum sometimes acts as a laxative. The method of administering the powdered guaiacum resin in cachets is far preferable to giving the tincture of guaiacum in a mixture, as in the latter form a nauseous mixture is produced and the precipitated resin tends to cling obstinately to the tongue and fauces. In cases of chronic cout the colchicum may very conveniently be administered in the form of a pill. given three times a day, containing of a grain of colchicine, combined with 1 of a grain of extract of nux vomica and 1 grain of extract of gentian. Colchicine, however, should not be given in cases of marked interstitial nephritis, as in such cases a fatal result has been known to follow its administration in medicinal doses. If constination occur a sulphur and guaiacum tablet or a dose of compound licorice powder should be administered at night. An occasional dose of blue pill and euonymin, followed by a purge of Epsom salts, will be found useful. If the patient is suffering from atony and debility of the stomach nux vomica or strychnine may be given with notassium citrate. Iron preparations are not, as a rule, well tolerated by the gouty, but if anomia is present the citrate of iron and ammonium or the carbonate of iron will be found the best to administer. Regarding the use of alkalies and the salts of alkalies, he says that of the potassium salts used in the treatment of gout the citrate and the bicarbonate are the two most commonly employed. As to the beneficial effects of employing a potassium salt in conjunction with colchicum in the treatment of acute and subacute gout he is fully assured, and he has found that of the various potassium salts the citrate is the most useful. If given in sufficiently large doses it tends. by its conversion in the kidneys into the carbonate, to diminish the acidity of the urine, which is generally high in connection with the gouty paroxysm, while at the same time it increases the solvent power of the urine for the uric acid salts, and so assists their elimination. In addition, as he has experimentally shown, the presence of a potassium salt both delays and inhibits the conversion of the soluble gelatinous sodium biurate, which is the form in which the biurate is first present in the blood, into the comparatively insoluble crystalline biurate. In this way the deposition of the latter in the tissues is inhibited, and so further time for the elimination of the biurate is offered. He does not, however, wish to contend that the above-mentioned are the only explanations of the beneficial action of potassium salts in the treatment of gout. In addition, they have their uses in the gouty state on account of their stimulating action on metabolism, of their remedial action on the gastric and hepatic functions, and

of their diuretic effect. As regards the use of sodium salts, they are certainly beneficial in some gouty conditions, but since they are directly detrimental to the removal of gouty deposits, he is of the opinion that those mineral waters should be avoided which owe their activity to those salts when the removal of gouty deposits is the main object of treatment. cases of sluggish action of the liver, of gastrointestinal catarrh and torpor, of gouty dyspepsia, and of other forms of irregular gout where there are no appreciable uratic deposits in the joints, mineral waters containing sodium salts are undoubtedly beneficial, owing to the action of those salts as hepatic and gastrointestinal stimulants. As regards the use of lithium salts in the treatment of gout, his opinion is that they are not so useful as the potassium and sodium salts. The lithium salts have not the same inhibiting effect on the conversion of gelatinous sodium biurate into the crystalline form as the potassium salts have, while at the same time they have no better solvent effect on gouty deposits. The great objections, however, to the use of the lithium salts is their greater toxicity and depressing action on the heart as compared with the potassium salts. They consequently have to be given in very small doses, and thus he is very doubtful as to whether in such doses they possess any remedial effect at all. On the other hand, he frequently meets with patients suffering from cardiac depression as the result of the excessive and continued consumption of lithia tablets, which are so persistently, so speciously, and so wrongly vaunted as curative of gout. Cataphoresis is useful in many cases of chronic gout with considerable deposits in the joints, and also in many cases of obstinate rheumatoid arthritis.

As far as the preventive treatment of gout is concerned, Dr. Luff has now had a considerable experience of the prophylactic effects of guaiacum resin, and he says that he knows of no drug that is more useful in the preventive treatment of gout. Its action is probably due to its stimulating effect on hepatic metabolism, thereby increasing, as it undoubtedly does, the elimination of uric acid. The form in which he prefers to give it is that of the powdered resin in cachets, commencing with doses of 5 grains three times a day after meals, and gradually increasing the dose to one of 10 or 12 grains. In this form it can be taken without any discomfort to the patient, whereas if administered in the form of the tincture in a mixture a most nauseous medicine results. Quinic acid is a comparatively new drug, which in various forms of combination has been put forward as possessing some beneficial action in the treatment of gout. It diminishes the output of uric acid in the urine, but simultaneously increases the secretion of hippuric acid. His experience of the different combinations of quinic acid is somewhat limited, but so far he is inclined to think that they are of decided use in the treatment of certain forms of chronic gout. The administration of fruits frequently reduces uric acid excretion, a result which has been attributed to the effect of quinic acid. Gowland Hopkins considers that this diminution is due to interruption of some synthetic process rather than to a mere effect on excretion.

The diet of gouty patients should be simple, that is, the meals should not be made up of too many articles. Simplicity of food means facility of digestion. Certainly meat, even red meat, should not be excluded from the diet. No class of food-stuff is so productive in energy as animal food; and as most

cases of chronic gout are suffering from lowered vitality and want of tone. animal food, at all events in moderate quantity, is distinctly indicated. author's experience supports the truth of this view, as he has advised in the great majority of cases of chronic gout the taking of at least one meat meal a day. The exclusion of any article of diet or of any class of food without taking into account the surroundings of the case and the neculiarities of the individual is unscientific. The value of a given mineral water in the treatment of gout depends greatly on the main object with which it is taken. instance, it may be taken to remove gouty deposits, or to stimulate the action of a sluggish liver and to relieve portal congestion, or for the treatment of gouty dyspepsia, or to relieve the bowels in cases of torpor and gastrointestinal catarrh, or to act on the kidneys, or to relieve gouty affections of the skin. Now it is manifest that any one mineral water is not likely to produce all these effects, and it is also obviously conceivable that a mineral water which might be most useful to effect one of these purposes might prove most injurious if employed to effect another. No doubt considerable error has arisen from indiscriminately sending gouty patients to a particular spa without giving due consideration to the question as to whether the water of that spa is suitable for the treatment of the specific gouty disorder from which the patient is suffering. Moreover, it is well to bear in mind that a patient should not be sent to a spa during the acute stage of gout, nor if suffering from marked organic disease of the heart or kidneys. A fairly bracing air with a low relative humidity is, in the experience of the author, the most suitable for the gouty. High mountain situations and valleys where there is an excessive relative humidity of the air are alike unsuited to the gouty. Especially is it desirable to avoid exposure to the cold east and northeast winds which prevail in this country in the early months of spring, and which are so ant to be provocative of what has been called a "chill on the liver," a condition which no doubt is brought about by the chilling effects of these winds on the skin, and a consequent reflex affection of the metabolism of the liver cells. As a winter resort for the gouty he knows of no better climate than that of Egypt, where, at Helwan (Helouan), thermal, sulphurous, and saline waters exist, and excellent baths are obtainable. The air of Helwan is that of the desert: the average winter temperature is 60° F.; the relative humidity from November to April is only 30 to 60 per cent., while the average rainfall for four consecutive winters was only three quarters of an inch. For the spring, summer, and autumn months we fortunately have for our selection a large number of health resorts in this country and on the Continent, the climates of which are well suited to the gouty. The author's experience is that residence by the sea is not suited to most cases of gout, and this especially applies to cases of gouty eczema.

Blood-letting in Uræmia.—Dr. M. Jaerisch (Münchener med. Wochenschrift, 1903, vol. xxix., No. 13, p. 232) communicates an observation on a young girl of seventeen years who had acute nephritis of unknown origin. Nothwithstanding careful medication, the patient was attacked with grave uræmic convulsions, there occurring between seven o'clock in the evening and five o'clock in the morning no less than forty-seven crises. She was promptly bled; 500 grams of blood were taken from her, followed by the

injection of a physiological saline solution. The patient did not recover until the second bleeding of 500 grams had taken place, following which the pulse rate became better and the convulsions diminished, and in a few days the patient had recovered.

Alcohol and Bacteriolysis.—Dr. H. A. Hare (Therapeutic Gazette, 1903, vol. xix., No. 5, p. 239) gives some interesting experiments to determine whether alcohol does good in infectious disease by increasing the bacteriolytic power of the blood, a subject which has been very much agitated in foreign laboratories. In these experiments, closely following out many others of the Continental workers, he comes to the following: (1) The conclusions to be reached from this research are that the use of alcohol seems to have the power of combating infectious diseases by increasing the bacteria-destroying power of the blood; (2) while the experiments so far made are too few and too contradictory to determine the question, they indicate so far as they have gone that this effect is produced, to some extent at least, by an increase in the complement.

GYNECOLOGY.

...

UNDER THE CHARGE OF HENRY C. COE, M.D., OF NEW YORK.

ASSISTED BY

WILLIAM E. STUDDIFORD, M.D.

Acute Diffuse Peritonitis.—Lennander (Deutsche Zeitschrift f. Chirurgie, Band lxii., Heft 1 und 2) recommends, during the early stage, the entire withholding of food by mouth, hypodermoclysis and ice-bags. Later he gives saline enemata and rectal alimentation with the subcutaneous use of olive oil.

Operative intervention is recommended when there is no evidence of gradual improvement, or if there is reason to suspect perforation of a viscus or pus sac. If pus is localized it should be mopped out with dry gauze, without irrigation, and a gauze drain inserted. The abdomen may be opened under local or light general anæsthesia and drained at the most dependent points, per vaginam, if there are pus foci in the pelvis. The writer is opposed to irrigation of the abdominal cavity in diffuse peritonitis unless it is impossible to dry it thoroughly and there is no danger of infecting healthy surfaces.

Tympanites is treated by puncture or incision of the gut. Intestinal paralysis may require the establishment of a fecal fistula. The after-treatment consists in frequent change of dressings, laxatives, nutrient enemata, and the subcutaneous injection of oil, saline or grape-sugar solution (5 to 10 per cent.).

FRIEDRICH (Archiv f. klin. Chirurgie, Band lxviii., Heft 2) found in cases of diffuse peritonitis numerous anaërobic bacteria, which produce dangerous toxins that exert an intense transient local irritation, varying with the amount of poison which is developed.

The essential point in the treatment is to open the abdomen in order to favor aerobiosis, while the introduction of saline solution into the circulation both assists the elimination of the toxins and at the same time strengthens the heart action. Subcutaneous injections of grape-sugar (3 to 5 per cent. solution) increase osmosis as well as supply nourishment. The writer has used hypodermically from one to three ounces of olive oil daily. In operating he seeks to remove the primary focus of infection and then to drain freely in all directions when there are extensive exudates. He saved seven out of nine cases of diffuse peritonitis following perforation of the appendix, but all the others died.

Changes in the Ovaries in Cases of Vesicular Mole.—Pick (Zentral-blatt f. Gynäkologie, 1903, No. 34) reviews the literature of this subject thoroughly and adds the report of an interesting case. He agrees essentially with Stoeckel, inferring that in cases of vesicular mole and epithelioma of the chorion changes occur uniformly in the ovaries—polycystic lutein degeneration or general overproduction of lutein.

Menstruation and the Corpus Luteum.—LINDENTHAL (Wiener klin. Wochenschrift, 1903, No. 11) believes that the amenorrhea sometimes observed after the extirpation of one ovary is due to the fact that the ripe follicle, the bursting of which would have caused the menstrual flow, was removed. This view, he thinks, is supported by the well-known fact that menstruation is often delayed for seven or eight weeks after unilateral oöphorectomy. In other words, it is not always true that the remaining ovary at once assumes the functions of the one which has been removed.

In order that menstruation may proceed regularly, it is necessary not only that Graafian follicles should be present, but that they should rupture every month and form corpora lutea. As long as no corpora lutea are formed, the genital organs remain undeveloped, and after their formation ceases the menstrual flow ceases and retrograde changes occur, though the ovary may contain follicles both before and after the period of sexual activity.

Hæmatocele Not Always Evidence of Ectopic Gestation.—Schambacher (Zentralblatt f. Gynäkologie, 1903, No. 36) calls attention to the fact that the mere presence of pelvic hæmatocele is not in itself a proof of the existence of extra-uterine pregnancy, in the absence of microscopic evidence. He believes that many cases of pure hæmatosalpinx are mistaken for ectopia in the absence of a careful examination of the blood as well as of the tube for chorionic remains.

Tuberculous Infection of Ovarian Cysts.—Prüsmann (Archiv f. Gynä-kologie, Band lxviii., Heft 3) reports a case, and cites twelve others from the literature. In his case the inner wall of the cyst was studded with tubercles containing typical bacilli. No evidence of tubercular nodules or infiltration

was found in the fibrous or serous layers or in the corresponding tube. In the broad ligament near the pedicle there were collections of leukocytes in the lymphatics, with giant cells. The writer infers that in this and in similar cases there is a secondary invasion of bacilli into the main eyst, usually from the infected tube, gut, or peritoneum. In all except the writer's case and one other the peritoneum was tuberculous. He infers that in his case infection occurred from the vagina through the lymph channels, possibly during coitus.

Epithelioma of the Chorion.—Fleischmann (Monatsschrift f. Geb. u. Gyn., Band xvii., Heft. 1) reports the case of a multipara who, three years after the removal of a vesicular mole, presented herself with a tumor which grew from the uterine cavity, filling the vagina. Since hysterectomy was not permitted, the growth was removed, and nine days later the uterine eavity was curetted on account of profuse hemorrhage. A quantity of soft tissue was removed and the uterine wall was accidentally perforated. A tampon was introduced, and the patient was again urged to have total extirpation performed, but refused; and after another profuse hemorrhage, left the hospital. Three months later she appeared in good health, having had no return of the bleeding. The vaginal cicatrix was normal, the uterus (previously as large as the gravid organ at two months) was small, and the adnexa free. Ten months after operation she was again examined and all her organs were healthy. Menstruation was regular and she had gained in weight.

A careful examination of the growth confirmed the previous diagnosis of epithelioma of the chorion, made up of syncytial epithelium, with metastasis in the vagiua. The writer regards the case as of unusual interest because of its slow development, the absence of hemorrhage before operation, and the perforation of the uterinc wall without subsequent illeffects. The return of the uterus to its normal size and the re-establishment of the menses and general health of the patient were equally remarkable. The case seemed to be an exception to the well-known history of these ncoplasms, which have always been regarded as so malignant that a radical operation offers the only hope of cure.

Adenoma of Gartner's Duct.—MEYER (Zentralblatt f. Gynükologie, 1903, No. 24) describes a congenital adenoma of the duet in an eight months' fœtus. Such growths found in the wall of the cervix uteri frequently develop from the remains of the duct, rather than from the Wolffian bodies. The writer also describes a cancerous uterus, removed at operation, in which microscopical examination showed marked glandular proliferation with transition to adenocarcinoma.

DISEASES OF THE LARYNX AND CONTIGUOUS STRUCTURES

UNDER THE CHARGE OF J. SOLIS-COHEN, M.D., OF PHILADELPHIA.

Fetid Atrophic Rhinitis.—At the recent Congress at Madrid (Archives Internationales de Laryngologie, d'Otologie, et de Rhinologie Supplement, May and June, 1903) Dr. Moure, of Bordeaux, recommended the attempt of distending the turbinates by interstitial injections of paraffin, which suppressed both secretion and fetor. These results are based upon the treatment of seventy typical patients by Drs. Moure and Brindel.

Nasopharyngeal Fibroma Cured by Means of Galvanocautery Puncture.—Dr. Urbano Melzi, of Milan, reports (Journal of Laryngology, Rhinology, and Otology, August, 1903) the case of a youth, fourteen years of age, who for some years had suffered with marked disturbance of nasal respiration, together with diminution of hearing and subjective noises on the right side. This was found to be due to a fibroma occupying a large part of the rhinopharynx toward the right, blocking the right choana and covering the Eustachian outlet. Attempts were made to destroy the tumor by bipolar electrolysis, but the applications produced copious hemorrhage, and were of no avail. Electropuncture was then substituted, the platinum point being introduced through the nares, keeping as close as possible to the base of the tumor, with passage of the current at intervals for ten minutes at each sitting. After a succession of a series of sittings extending through a period of three years the last trace of the growth had disappeared.

Sarcoma in the Nasal Passage.— Dr. J. Price-Brown, of Toronto, Canada, reported to the Laryngological Section of the American Medical Congress at Washington (Laryngoscope, August, 1903) the case of a large sarcoma in the left nasal cavity of a young man twenty-one years of age. Twelve pieces of the growth were removed with either snare or scissors, and seventy-four electric cautery operations performed before its complete disappearance. The difficulties in the way of hemorrhage and other complications are detailed in the communication.

Facial Neuralgia from Antral and Nasal Disease.—At a recent meeting of the American Laryngological Association (Laryngoscope, August, 1903) Dr. W. Peyre-Porcher, of Charleston, S. C., reported six cases of facial neuralgia due to disease of the nose and antrum. Some of these cases had been subjected to severe surgical procedures, including the removal of the Gasserian ganglion without permanent relief, but were eventually cured by operations upon the nose or antrum; structures which had not been

examined by any of the medical men who had had previous charge of the cases.

Inference is drawn that many cases of trigeminal neuralgia are due to lesions in the nose and maxillary sinuses, and that thorough examination of these structures should precede any resort to resection of nerve or procedure still more serious.

Lipoma of the Tonsil.—In a paper read before the American Laryngological, Rhinological, and Otological Society (Laryngoscope, August, 1903) Dr. Clement F. Theisen, of Albany, N. Y., reports the case of a lipoma of the tonsil in a female child three years of age, and gives a ré-umé of a number of other instances, together with a copious bibliography. He states that there is little doubt that lipomata are due to some congenital aberration, inasmuch as the tonsil does not contain any fat. Nevertheless, he finds it rather remarkable that the majority of cases were observed in adults, the patient in one instance being a woman more than ninety years of age.

Hemorrhage following Tonsillotomy.—In an article on this subject Dr. Additional Additional Medicine, July 4, 1903) an instance in which his services were required for a lad of seven years of age, twenty-five hours after he had been operated upon for bilateral hypertrophied tonsils which had been excised without difficulty with the tonsillotome and without the use of any anæsthetic whatever. The pillars were intact, and a parenchymatous hemorrhage was seen in the left tonsillar region. Under a few whiffs of chloroform the Paquelin cautery, heated to a dull cherry red, was applied directly to the bleeding surface, and the cessation of the hemorrhage was immediate and permanent. The patient's general condition was so precarious that an infusion of normal salt solution was injected into the left median basilic vein to the amount of 700 c c. with good effect. The physician who had performed the operation had seen the patient six hours afterward, and at that time there had been neither hemorrhage nor scrious symptoms of any kind.

Foreign Bodies in the Tonsil; Removal of a Bullet in the Throat Two Years after Infliction of the Wound.—Dr. J. Cander Pierce, of Bussilo, N. Y., reports (American Medicine, July 11, 1903) this curious case. A lady with an ulcer on her right tonsil applied for treatment for throat trouble of some two years' duration. On probing the ulcer a supposed calcarcous deposit was struck; but noticing some powder marks on a sear of the patient's left cheek, she was asked whether she had been shot, and replied in the affirmative, stating that it was supposed that the bullet had escaped through the mouth, but she had had more or less trouble with her throat ever since. By means of knife and artery forceps the doctor then removed a 32-calibre bullet from deep behind the right tonsil.

Foreign Bodies in the Œsophagus.—Dr. A. H. Traver, of Albany, N. Y., reports (American Medicine, July 11, 1903) the removal of an open safety-pin from the esophagus of a female child nine months of age. The

pin was located by the Roentgen ray half-way down the œsophagus-too low for access by esophagotomy. The pin was open with point upward, so that it would have been impossible to remove it through the mouth with forceps. The following procedure was adopted: "The child was anæsthetized with chloroform and placed on a table, beneath which the Roentgen-ray tube had been placed, so that the pin could be seen without difficulty. While thus keeping watch of the pin, a whalebone bougie, which could also be seen, was passed down the esophagus until it came in contact with the safety-pin. Then, by means of the bougie, the pin was carefully pushed down into the stomach, and was seen to fall down into the cardiac end. The bougie was then removed. The child was now taken to the operating room. The abdomen was opened in the median line. The pin was located and worked up under the anterior stomach wall. An incision one-fourth of an inch long was made through the wall of the stomach and the pin removed. The incision in the stomach was closed with Lembert sutures, and the abdomen was closed in layers. The wound was dressed in the regular way. The child made an uneventful recovery, and left the hospital on the seventh day."

Retained Intubation Tubes.—For reports of some practical experiences in these cases we would refer to articles by Dr. Arthur B. Duel, of New York (New York Medical Journal, May 2, 1903) and Dr. Wm. T. Watson, of Baltimore (Maryland Medical Journal, May, 1903).

DERMATOLOGY.

UNDER THE CHARGE OF

LOUIS A. DUHRING, M.D., PROFESSOR OF DERMATOLOGY IN THE UNIVERSITY OF PENNSYLVANIA,

AND

MILTON B. HARTZELL, M.D., INSTRUCTOR IN DERMATOLOGY IN THE UNIVERSITY OF PENNSYLVANIA.

Acne and its Treatment.—G. H. Fox (Journal of Cutaneous Diseases, March, 1903) presented an article on this subject before the American Dermatological Association, in which he states: "Of the medical treatment of acne, little need be said. A dose of salts or castor oil may often benefit the patient, but no one would be apt to speak of these as remedies for acne. In like manner calx sulphurata, ergot, glycerin, arsenic, and other drugs may, under certain conditions, prove of some service to a patient with acne, but the direct action which they produce upon an acne eruption has been greatly overrated, and their routine use by many physicians on the strength of textbook commendation is greatly to be regretted. . . . In the local treatment the best results are to be attained by measures which may be termed dynamic rather than chemical. These include massage, friction, and the use of instruments intended to empty the distended and obstructed follicles." The best instrument for general use is the curette. It is better than the lan-

cet. The author concludes by recommending "a strict dict, cold baths, systematic exercise, and the frequent use of the curette." [In the discussion of this paper certain members present were of the opinion that, while the curette might be useful in some cases, it certainly was not applicable to all, and there were other methods of treatment, both internal and local, worthy of consideration.]

Recurring Polymorphous Erythema.—Gensollen (Annales de Derm. et de Syph, February, 1903) calls attention to this form of disease, stating that Hutchinson first, and later Bault, described such cases. Instances occurring in the practice of the reporter, as met with in Bordeaux, are next cited. There seems to be nothing remarkable about such cases, beyond the fact that the cutaneous lesions appear in recurring attacks or crops, and that each principal attack is made up of a series of successive attacks, which may last two weeks or longer. The diseases with which it is not to be confounded are (1) antipyrin erythema and (2) dermatitis herpetiformis, and it is especially from the latter disease that it must be differentiated; but dermatitis herpetiformis is altogether a more chronic process, is more polymorphous in the same attack, and is accompanied by much more itching.

Pseudoleukæmic Prurigo.—Radcliffe-Crocker (British Journal of Dermatology, March, 1903, p. 98) reports a case of this disease in a piano finisher, aged forty-one years, apparently following a scratched finger, the wound healing rapidly, but followed a week later by a lump in the right axilla. Three months later there were several lumps as large as small eggs, with processes from them extending downward. These were extirpated, but soon afterward the glands in the left axilla enlarged, and later in the inguinal region and elsewhere. The spleen was not enlarged, the skin lesions were chiefly on the buttocks and upper half of the thighs, but also elsewhere, occurring as numerous superficial, purplish nodules the size of hempseeds and nearly all of them were exceriated from scratching, due to severe itching. The itching continued unabated until the death of the patient, about two years from the onset of the disease. The existence of severe itching in such cases, with enlargement of even a few glands, would suggest a pseudo-leukæmic rather than a tubercular nature.

Four Cases of Syphilis Mistaken for Smallpox.—Schamberg (Journal of the American Medical Association, November 29, 1902), in commenting upon such cases, states that errors of this kind are not infrequently made by physicians during epidemics and occasionally at other times, and calls attention to the points of difference in the differential diagnosis. In variola the palms and soles rarely escape, except in extremely mild cases; in syphilis these regions are seldom invaded. The syphilitic lesion possesses a firmer or harder base, and is more acuminate than the variolous, the pustulation involving the upper central portion, whereas in variola the lesions are completely involved in the pustular process and are globular and full. The course of the variolous process is rapid, while that of the syphiloderm is slow. The presence or absence of adenopathy cannot be relied upon as a diagnostic point. Most weight is to be placed upon the uniformity of the eruption and

the general symptoms in variola, and upon the crop-like appearance and the firmer, more solid base of the pustules in syphyilis.

Vaccinal Eruptions. -- STELWAGON (Journal of the American Medical Association. November 22, 1902) states that the most notable cutaneous manifestations are of the form of erythema multiforme, urticaria, impetigo contagiosa, and pemphigoid lesions. The most generalized eruption observed was of a mixed type of urticaria and erythema multiforme—that is, a manifestation of an erythema multiforme with itching and other symptoms of urticaria. The cases of urticaria noted were marked by a disposition to the formation of vesicles and blebs; a generalized pemphigoid eruption, having the features of acute pemphigus and dermatitis herpetiformis, was observed in three instances, and having a tendency to persist over a period of months. Eczema sometimes follows vaccination, but probably only in those individuals who possess a plain tendency to eczema. On the other hand, improvement or cure of the eczema occasionally follows the vaccination. The view is expressed that psoriasis is never caused by vaccination, and that lupus, syphilis, and leprosy may be transferred by vaccination, but such instances are rare. The two latter diseases cannot be conveyed when bovine lymph is employed.

Note on the Histology of Herpes Zoster.—S. Pollitzer (Journal of Cutaneous Medicine, February, 1903) describes a peculiar form of vesicle in herpes zoster, which affected the mucous layer of the hair-follicle exclusively, and differed histologically from the usual vesicle as it occurs in this disease, It was a secondary effect of the real herpes zoster vesicle, which was located in the root-sheath of the hair-follicle, whence a serofibrinous exudation travelling up between the inner and the outer root-sheaths of the follicle raised up the corneous layer at the follicular orifice, producing there the visible vesicle. It is in reality herpes zoster of the hair-follicles, and has not been described before.

A Mild Inflammation of the Skin Covered by Greenish Scales, Probably Produced by B. Pyocyaneus.—M. F. Engman (British Journal of Dermatology, April, 1903, p. 156) describes a rare case in which there existed a greenish, scaly eruption on the scrotum, the upper part of the thigh, and the perincum, chiefly on the left side. He wore a suspensory bandage, and noticed a green stain on it, which was worse when he sweated freely. B. pyocyaneus was found in the scales, so the disease was not due to malingering nor to dye in the bandage.

Case of Systemic Blastomycosis, with Cutaneous Lesions.—Ormsby and Miller (Journal of Cutaneous Diseases, March, 1903) give the result of their studies of a case in the laboratory of Drs. Hyde and Montgomery. The patient was a Swede, aged fifty-six years, a machinist, who from childhood never was robust. The first evidence of the illness which ended fatally was exhibited in the lungs. Early general toxemia was present, as evidenced by fever, weakness, and emaciation. The cutaneous manifestations began two months after the initial illness, and were manifestly of internal origin, coming by way of the eirculation. These lesions comprised subcutaneous and cutaneous nodules

and abscesses, open and discharging, or crust-covered ulcers, and were extensively distributed, being, as a rule, smaller about the head and face and larger on the extremities, the trunk having comparatively few. Pure cultures of blastomycetes were obtained from the subcutaneous abscesses before death and from various tissues and internal organs after death. Microscopic examination of both the internal and external lesions and the sputum failed to show any tubercle-bacilli, but all showed enormous numbers of blastomycetes. The lungs were riddled with miliary abscesses and tubercle-like lesions, the pleura studded with nodules, and the liver and kidneys, the spleen, and the mesentery were similarly affected. The early lung involvement and other symptoms all suggested tuberculosis, but the absence of tuberele bacilli, culturally, microscopically, and experimentally, the negative tuberculin reaction, the absence of the usual microscopic tubercular architecture, the failure to reproduce tuberculosis in animals, the extraordinary number and rapid evolution of the cutaneous lesions, and, lastly, the abundance of the blastomycetes in every lesion, ruled out tuberculosis. Photographs accompany the article.

The Light Treatment of Lupus and Rodent Ulcer.—A. J. Harrison and W. K. Wills (Journal of Cutaneous Diseases, June, 1903, p. 295) give results obtained in the Bristol General Hospital in 1901 and 1902. At first two Lorbet-Genoud lamps, made by Marshall & Woods, of London, and later two lamps made by Miller were employed. The current used was an interrupted one—5 to 10 ampères, about 12 volts, and the time of sitting at the lamps five to twenty minutes. The report covers 42 cases of lupus vulgaris, 3 of lupus erythematosus, 12 of rodent ulcer, and other miscellaneous cases. In the lupus cases almost all were benefited or greatly improved; a small percentage only were unsatisfactory. Two out of the three lupus erythematosus cases were improved, but made more rapid progress under X-ray treatment. The 12 cases of rodent ulcer were treated chiefly with X-rays and were markedly benefited.

On Light Therapeutics.—BIE (British Journal of Dermatology, May, 1903, p. 191, from Wien. klin. Rundschau, No. 37, p. 723) upholds the views of Bouchard, Widmark, and Finsen as regards the capabilities of the chemical rays, but not red, yellow, or green rays, to produce inflammation of the skin. Blue and violet rays can penetrate deeply into the skin only when it has been made bloodless. Ultra-violet rays can, under no circumstances, penetrate deeper than the superficial layer of the skin, but here they may give rise to dilatation of the vessels which can persist for five or six months. Bie gives the following conclusions: (1) Finsen's treatment of smallpox with red light depends on the exclusion of the irritating action of chemical light rays, and thus the prevention of pus-formation in the vesicles, secondary fever, (2) The red-light treatment of other exanthemata has not yet been thoroughly tested. (3) The universal light treatment of the future will undoubtedly be sun-baths or exposure of arc lamps of 150 to 200 ampères, but now too little is known of the general action of light for definite indications. (4) The single method of light treatment whose success is firmly established is Finsen's method of treating skin diseases with concentrated chemical rays.

This method is essentially preservative; hence the excellent results as to scarring, the scars being white and smooth. Healthy skin can be exposed to the rays as well as the diseased skin, thus diminishing the danger of recurrence. The treatment is free of pain and the results good. Of 640 patients, only 1.7 per cent. had to abandon treatment on account of unfavorable results; 85 per cent. showed positively favorable results; and in only 15 per cent. was the improvement so slow that the treatment had to be described as less successful

Treatment of Rodent Ulcer by X-rays.—J. H. Sequeira (British Medical Journal, June 6, 1903), who is in charge of the X-ray and Finsen-light Department of the London Hospital, in this article refers especially to the changes produced in the growth, the question of recurrence, the selection of cases, and the conditions which favor success. The following practical points are worthy of being quoted: The custom in the hospital is to apply the rays on alternate days in the milder cases, and daily in the severer forms of disease. The tubes used are those which spark from four to six inches, but the therapeutic value of the tubes is a variable thing, and one which it is at present impossible to explain. "High" tubes are valuable, as the rays can be applied until there is a definite inflammatory reaction. Actual "burning" is not necessary, and some of the best results are obtained without any inflammatory reaction at all. The surrounding skin is protected with leaden masks.

Electrolytic Treatment of Xanthelasma.—Pansier (Arch. d'Electr. Médicale, July, 1902) recommends the use of the negative pole thrust into the growth and the application of the positive pole to the back of the neck. The patch should be transfixed by the needle. Steel needles may be used. From six to ten milliampères are employed for about two minutes. The result is a soft, non-retractile scar. The method is not painless, but this may be minimized by rubbing the eyelid with menthol and chloral hydrate, of each 46 grains in 98 grains of lanolin. Several treatments at intervals of about two weeks usually suffice.

OPHTHALMOLOGY.

UNDER THE CHARGE OF

EDWARD JACKSON, A.M., M.D., of denyer, colorado,

AND

T. B. SCHNEIDEMAN, A.M., M.D., PROFESSOR OF DISEASES OF THE EYE IN THE PHILADELPHIA POLYCLINIC.

Cocaine. How and When to Use It in Inflammatory Affections of the Eye.—Prof. Fuchs, Vienna (Wien. klin. Woch., 1902, No. 38), is convinced that this remedy is frequently improperly prescribed. It should never be

put in the hands of patients to relieve ocular pain. In fact, in conjunctival maladies the suffering as a rule is not extreme; in disease of the deeper parts, iridocyclitis, glaucoma, etc., affecting as it does but the superficial parts, it is of no value. In corneal affections the pains may indeed be often relieved by cocaine, and the physician may venture himself to make an occasional instillation; but the effect is transient, the pain quickly returns. If the patient is given the remedy he is pretty certain to use it again and again, and in that way do harm to the cornea, or at least retard healing, for it must not be forgotten that cocaine is hurtful to the cornea; it frequently causes opacities or even abrasions of the epithelium, which latter may eventuate in ulccration. It occasionally brings on an attack of glaucoma in predisposed eyes.

Prof. Fuchs employs cocaine frequently, e. g., in all operations, even the least important, such as the removal of foreign bodies from the cornea. makes several instillations of a 5 per cent. solution, and has the patient keep his eyes closed between the instillations, to obviate injury to the epithelium, which is the more likely to occur because of the desiccation that results from infrequent winking. In operations upon the lids cocaine is injected beneath the skin; in those upon the muscles beneath the conjunctiva; upon the tear passages within the same; in operating upon chalazion, besides instillation into the conjunctival sac, a couple of drops are injected into the cyst itself, rendering the curetting absolutely painless. Cocaine acts well in photophobia, as in the scrofulous ophthalmia of children, but it is not to be given to the parents. Experience teaches that the photophobia rapidly diminishes and frequently disappears in a few days if the eyes can be kept open for a little while daily. The author recommends in these cases that several instillations be made in the morning, when the photophobia is usually greatest; by this treatment the children will often keep their eyes open freely for half an hour, and this suffices to permanently relieve the photophobia to a great extent. It is often advantageous to moderate photophobia by instillation of cocaine to render possible a more careful examination of the eyes. Cocaine may be used to dilate the pupil for ophthalmoscopic examination; although not fixing the pupil, it permits pretty active contraction when the macula is brightly Many employ cocaine and atropine in combination where illuminated. dilatation of the pupil is difficult to obtain, as in severe iritis, making the instillations as often as every two hours. Fuchs is against this method. Such frequent instillations of atropine often occasion toxic effects; moreover they irritate the conjunctiva, and frequently fail of the desired effect. Under these circumstances the author recommends that atropine be used at long intervals, but in heavy doses; he recommends the insertion of a small quantity of the salt in substance in the conjunctival sac, at the same time preventing the entrance of the tears into the nosc by retracting the lower lid or making pressure over the sac. This method is not to be employed in the case of little children who react so strongly to atropine. But the greatest effect is obtained from a combination of cocaine and atropine employed in the following manner: the eye is at first cocainized as preliminary to an operation, the atropine is then placed in the conjunctival sac in substance. This method of applying the mydriatic accomplishes everything that such a drug can possibly do in severe iritis, loosening old synechiæ, or freeing the iris after recent prolapse into a corneal wound or ulcer. Cocaine not being permissible

to the patient in painful ophthalmias, what is to be done? First, internal medication, c. g., aspirin, which has a special advantage in iridocyclitis, and warm applications locally. A free leeching often cuts short the pain in iridocyclitis and aids mydriasis. Dionin is also to be recommended in substance or in 5 per cent. solution. A drop of cocaine previously instilled prevents the rather severe burning produced by it. Dionin sometimes causes marked inflammatory ædema of the conjunctiva. The ædema subsides in a few hours, becoming less marked the longer the drug is employed. As the reaction to this drug is somewhat uncertain, the surgeon had best make the first application himself and observe the effects. In spite of apparently augmenting the external inflammatory symptoms, dionin frequently has a happy effect in pain accompanying diseases of the cornea as well as iridocyclitis. It also exerts a beneficial influence upon the photophobia as well as the diseased processes themselves.

The Pupil in Tabes.—A. ROCHON-DUVIGNEAUD and J. HETTZ (Arch. Gén. de Méd., July 7, 1903) report the results of their examination of the eyes of seventy-seven tabetics, with special reference to the reactions of the pupil. In 30 per cent. of the cases examined the Argyll-Robertson sign was incomplete; 30 per cent. of cases present bilaterally, 13 per cent. unilaterally, a complicated Argyll-Robertson sign, viz., diminution or abolition of contraction upon convergence; myosis is regularly present when the Argyll-Robertson sign is pure; optic atrophy rarely accompanies myosis; ophthalmoplegia externa or interna is even more rare; mydriasis is present only when all light perception is lost and contraction to convergence is frequently diminished or absent; when mydriasis accompanies a normal fundus, total ophthalmoplegia interna is usually present; mydriasis is most often present in those cases where the pupillary reaction to accommodation and convergence is lost, the power of accommodation being preserved.

Roentgen and Becquerel Rays in Ocular Therapeutics.—Darier communicated to the Ophthalmological Society in Heidelberg, September, 1903 (Woch. f. Ther. u. Hyg. d. Aug., Sept. 24, 1903), a series of cases treated by these rays: multiple tumors of the eyelids, conjunctiva, face, neck, and almost the entire mediastinum as far as the heart (as shown in a skiagraph). The rapid spread and the microscopic examination showed the malignant nature of the growths (alveolar round-celled sarcoma). Severe attacks of spasmodic cough with dyspnæa were endangering life. After ten ten-minute treatments by the Roentgen rays in the course of fifteen days, all the tumors of the face had disappeared. The cough and dyspnæa also vanished. The radioscope showed diminution of the mediastinal growths.

The following cases were treated with the Becquerel rays obtained from radium. These rays are known to be identical with the Roentgen rays, so that a like result is to be expected from them, with a simpler mode of application which can also be graduated: hereditary specific periorbital neuralgia with choroiditis. The pain completely disappeared after twenty-four hours' application of radium. Antipyrin, quinine, phenacetin, as well as potassium iodide and mercury, had been tried without effect. A man affected with

acnte blenuorrhæic iritis with severe pains had been treated without result with atropine, dionin, aspirin, and sodium salicylate. After a few hours' application of radium the pain entirely disappeared, and the pupil, which had remained contracted in spite of frequent instillations of atropine, and scopolamine (leeches had also been applied), soon dilated, showing postcrior synechia. In three cases of iridocyclitis following traumatic cataract, pain was entirely relieved after a few hours, and the congestion decidedly diminished. In none of these cases was there a return of pain. In one case of old hemorrhage of the vitreous following perforating wound of the sclera, twenty-four hours' application of radium produced an extraordinary clearing up of the opacities, so that the papilla could be seen, and the vision improved from 1/10 to 1/3. Two cases of detachment of the retina and one of parenchymatous keratitis gave negative results.

Treatment of Atrophic Retinæ with Retinal Extract.—DOYNE (Brit. Med. Jour., July 25, 1903) reports marked improvement from the administration of extract of fresh retinæ, six to nine daily, in retinitis pigmentosa, retinal degeneration in high myopia, choroiditis, and tobacco amblyopia. He thinks that cases of asthenopia from functional exhaustion would also be benefited.

The Value of Ophthalmic Examinations in the Differential Diagnosis between Typhoid Fever and Acute Miliary Tuberculosis.—Loeb (Arch. of Ophthal., September, 1903) reports a case of miliary tuberculosis diagnosed by the finding of choroidal tubercles. The patient was under his observation for three weeks, during which time the tubercles increased in size and number.

The autopsy revealed a general miliary tuberculosis. Tubercle bacilli were demonstrated in the new-growths in the eyes.

Tubcrcles of the choroid to be ophthalmoscopically visible must possess a diameter of more than 0.6 mm. There are usually no changes in the refractive media, and no hemorrhages. The tubercles may appear at any stage of the disease, and sometimes grow so rapidly as to become ophthalmoseopically visible over night; a second or even a third examination may be needed to demonstrate their presence. The ocular tuberculosis may be a part of a general miliary tuberculosis, or it may be the only foeus demonstrable in the body.

Authorities differ as to the frequency with which tuberculosis of the choroid occurs in general miliary tuberculosis. The two extremes given are 10 per cent. and 82.7 per cent. The author thinks that we may expect to find choroidal tubercles in 50 per cent. of the cases of general miliary tuberculosis.

PATHOLOGY AND BACTERIOLOGY.

UNDER THE CHARGE OF

SIMON FLEXNER, M.D.,

DIRECTOR OF THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH, NEW YORK,

ASSISTED BY

WARFIELD T. LONGCOPE, M.D., RESIDENT PATHOLOGIST. PENNSYLVANIA HOSPITAL.

Observations on the Distribution and Culture of the Chancroid Bacillus.—Davis (Journal of Medical Research, 1903, vol. ix. p. 401) has made an examination of the pus of forty cases of genital ulcerations clinically resembling chancroid. In thirty-two bacilli were found corresponding exactly in morphology and staining reactions to the Ducrey bacillus, the characteristic chain arrangement occurring in ten of these. On media containing a considerable proportion of fresh blood, pure cultures of the Ducrey bacillus were obtained directly from the pus of primary genital chancroids in two cases, and in many others there was a growth of this organism, mixed, however, with contaminating bacteria. One instance of chancroid ulceration of the skin of the abdomen, resulting from accidental autoinoculation from a genital lesion yielded pure cultures. Of seven chancroidal buboes, pure cultures were obtained in three cases. Besides the primary genital lesions, the bacillus was cultivated in pure culture from two cases of primary extragenital chancroid, the ulcerations appearing upon the fingers.

The bacillus may be identified by its morphology and staining reaction, together with its inability to grow on ordinary culture media. The growth is most luxuriant in a medium of fresh blood and bouillon, but unmixed human blood is the best medium for obtaining cultures from a source open to contamination.

A guinea-pig was inoculated by rubbing in two loopfuls of a pure twenty-four-hour culture upon a scarified area on the back, but the result was negative. Monkeys of the genus Macaccus hemestrinus were inoculated by the same method and developed definite ulcers from which the Ducrey bacillus could be isolated.

The author believes that chancroid may be primary upon an extragenital site, and that bacteriological examination of all ulcers of this type is likely to establish in the future a greater prevalence of extragenital chancroid than has hitherto been reported.—W. T. L.

On the Pathology and Bacteriology of Landry's Paralysis.—Buzzard (Brain, 1903, part i. p. 94), in reviewing the pathology and bacteriology of Landry's paralysis, calls attention to the disproportion between the histological changes which can be demonstrated in the brain, cord, and peripheral nerves in certain cases and the grave clinical manifestations which characterize the disease. In a few cases no demonstrable lesious are found in the

nervous system; in a large majority of cases the lesions are such as may be produced by the action of a microbic toxin apart from the microbes themsclves, and in this latter group bacteriological examinations prove negative. A few instances make up a third group in which the changes are those of a disseminated or diffuse myelitis or meningomyelitis, and in some of the eases pathogenic organisms have been found in the meninges, spinal cord, cerebrospinal fluid, and occasionally in the blood. Among the most notable observations are those of Courmont and Bonne, Roger and Josué, and Russell. These observers have demonstrated in the blood or meninges of this latter type of the disease a diplocoecus which they considered bore certain resemblances to the meningocoecus of Weiehselbaum and to the pneumoeoceus. The author reports a typical ease of Landry's paralysis in a man aged thirty-three years. There was a gradual ascending paralysis which lasted for about eighteen days and terminated with involvement of the respiratory museles. At autopsy there was no noticeable alterations in the nervous system. Microscopic examination showed morbid changes of very slight degree of intensity, but of rather wide distribution, consisting principally in a chromatolysis of the gauglion cells of the anterior and posterior horns of the spinal cord. In cultures from the blood a diplococcus was isolated which stained fairly well by Gram's method. It grew slowly on the ordinary culture media. In sections of the dura mater a diplocoecus could be demonstrated which resembled in morphology the coccus isolated from the blood. A subdural injection of the cultivated coccus into rabbits produced, after some days, a rapidly spreading palsy, and from the blood and dura mater of these animals the same organisms could be cultivated. author draws attention to the unusual situation of the coccus, namely, in the dura mater, and suggests that careful bacteriological examination of this membrane should be made in cases similar to that under discussion .-W. T. L.

Experiments on Tuberculosis.—Dean (Journal of Pathology and Bacteriology, 1903, vol. viii. p. 458) reports a series of interesting and eareful experiments concerning the infection of animals by tubercle bacilli obtained from human sources. Observations were first made to determine whether the virulence of tubercle bacilli from the sputum of tuberculous patients could be increased for ealves by an intermediate passage through pigs, eats, rabbits, and rats. The intermediate animals were inoculated with tuberculous sputum, allowed to die of the disease, and then from the most extensively affected organs the tuberelc bacillus was cultivated upon artificial Finally, ealves were inoculated subcutaneously from these cultures. Previous to the inoculations all possible precautions were taken to prevent any contamination of the calves from tuberculous cattle, and each animal received injections of tuberculin to exclude the possibility of bovine tubereulosis. After an interval of several months the ealves were killed, full autopsies were performed, most of the organs were examined microscopically, and inoculation experiments made with rabbits and guinea-pigs. Of the eleven ealves used, a tuberculous focus was found only in one or two. This consisted in a small, caseous nodule, which was discovered at the site of primary inoculation. Control calves inoculated directly with tuberculous

sputum developed an extensive glandular tuberculosis. The author, in explaining this apparent diminution in the virulence of the bacillus tuberculosis for the calf, emphasizes the fact that in the one case the associated organisms of the sputum had been eliminated by passage through the intermediate animals; whereas in the other case it is possible that they played an important part in aiding the attack of the tubercle bacillus. This conception was apparently strengthened by experiments upon direct inoculation of pigs with tuberculous sputum and by feeding the animals upon the material. Six pigs inoculated with tuberculous sputum developed an extensive general tuberculous infection, some dying rapidly of the disease; and three pigs fed upon tuberculous sputum, mixed with wheat meal, wasted and died, having developed tuberculosis of the tonsils and cervical glands. The author thus concludes that the pig is capable of developing a rapidly fatal general tuberculosis as the result of infection with the human tubercle bacillus.—W. T. L.

Trypanosomiasis of Horses in the Philippine Islands.-Musgrave and WILLIAMSON (from the Biological Laboratory, Bureau of Government Laboratories, 1903, No. 3). The discovery of trypanosomiasis in the Philippine Islands was made by Jobling in 1901, but the first published report concerning this affection came from Smith and Kinyoun somewhat later in the same year. It is practically certain that before this time the disease did not exist in these islands, and now it is possible to trace its introduction to a shipment of horses, some of them race-horses, from Australia to Manila, in May, 1901. Since then the loss of animals from "sura" has been appalling. Trypanosomiasis, so far as is known, is a wound disease, and should the infectious agent come in contact with a wounded surface, either the skin or mucous membrane, of a susceptible animal, the disease readily develops, Proof of the transmission of the disease through biting flies has been furnished from Africa, India, and South America, and these observations have been confirmed by the authors in their investigation of the Philippine epidemic. The period during which flies are capable of transmitting the disease after feeding on infected blood appears to be less than forty-eight hours. Apparently the fly acts as a mechanical means for the spread of the disease, and not as an immediate host for trypanosoma. Since certain rats in Manila have been found to harbor the same parasite as the horse, fleas from rats may also be considered as a source of infection. The authors found it impossible to infect healthy animals by administering the blood of an infected animal mixed with food; unless abrasions were made upon the mucous surface of the mouth of the animals used for experimentation, the horses did not develop the disease. Trypanosoma are carried directly from animal to animal, and no lower form of organism is known to play the part of intermediate host. The parasite does not exist outside the animal body. The incubation period of the disease is from four to six days. After this time the temperature rises and parasites are found in the blood. acteristic symptoms of the disease are the fever, anæmia, odema, particularly of the hind legs, paresis, and emaciation. Early in the disease there may only be fever, and at this time a diagnosis can only be made from an examination of the blood. Later the clinical picture is typical. The course of the disease varies from two to six or eight weeks, and is always fatal inhorses. The methods which the authors suggest to rid the Philippines of the disease are the prevention of infection of the country by proper quarantine laws and the eradication of the present infection by enforcing efficient sanitary regulations.—W. T. L.

Observations upon Banti's Disease and Splenomegaly.—Borissowa (Virch. Arch., 1903, Bd. 172, page 108) diseusses the pathological changes found in Banti's disease and splenomegaly, recording two fatal cases with careful microscopic descriptions. In the first one, that of a woman, aged fifty-two years, the spleen was of an enormous size, and the general condition was complicated by a recurring ascites. At autopsy a tuberculous peritonitis obscured somewhat the pathological picture. There was no cirrhosis of the liver. The spleen, in microscopic sections, showed a widening of the blood sinuses, with proliferation of the lining endothelium, which resulted in the accumulation of great numbers of large endothelioid cells in the blood spaces. There was, besides, extensive thickening of the reticulum. Eosinophiles were quite numerous. In both the liver and bone-marrow many capillaries were found packed with large cells similar to those seen in the spleen, and the author believes that such cells were carried from the spleen to these situations by means of the blood stream.

The second case was that of an infant aged nineteen months. In the spleen much the same appearance was met with as in the first case, except that the endothelioid proliferation was not so extensive, and both red-blood corpuscles and pigment were found included in the swollen endothelial cells lining the venous spaces.—W. T. L.

The Action of the Tubercle Bacillus in Experimental Pulmonary Tuberculosis.—HERNHEIMER (Zeigler's Beiträge, 1903, Bd. xxxiii. p. 363) reports the results of a series of experiments in which tubercle bacilli were inoculated into the trachea of guinca-pigs. As early as one-half to one hour after the intratracheal injections tubercle bacilli were found to pass through the bronchi and bronchioli into the alveoli. During their passage through the bronchi a definite chemotactic influence was exerted upon the polymorphonuclear leukocytes which made their way through the walls of the bronehioles and eventually collected in the lumen of the bronehus about clumps of tubercle bacilli. The greatest portion of the bacilli, however, appeared to reach the alveoli without greatly damaging either the epithelium or the walls of the bronehi. In the alveoli they were immediately taken up by the alveolar epithelium, and though most of the phagocytic epithelial eells were desquamated, some still remained attached to the alveo-At the same time the bacilli brought about a destruction of the elastic fibres of the lung. As a result of this damaging influence upon the stroma and parenehyma, a proliferation of the epithelium and fixed connective-tissue eells took place. The tuberele bacillus likewise caused a necrosis of the single cells, and appeared positively chemotaetic for the polymorphonuclear leukoeytes. The tissue about the larger collections of bacilli was entirely destroyed, and an infiltration of great numbers of polymorphonuelear loukoevtes resulted. These eells, however, in their turn, rapidly degenerated. At this time giant cells appeared, more especially about the periphery of the tubercle. The author traces the origin of the giant cells to the epithelioid cells, and believes that they arise as a result of a partial necrosis of the cytoplasm. Following upon the destructive properties of the multiplying tubercle bacilli, total necrosis and caseation of the tissues developed, beginning at the centre of the areas of infiltration. The author believes that though his conclusions are drawn from animal experiments, the results of his investigations are applicable to man as well as to animals.

Experimental Researches upon Cancer in Mice. - Jensen (Zent. f. Bakt. u. Paras., 1903, xxxiv. 122) reports a series of experiments made with a carcinoma obtained from a white mouse. The primary tumor had a typical carcinomatous structure, although there were no metastases. Portions of this tumor were transplanted through nineteen generations of white mice. and successful results were obtained in from 40 to 50 per cent. of the cases. The transplantations were usually made either by placing small portions of the tumor or mixtures of tumor and salt solution beneath the skin of the mice. Besides the variety of white mice in which the tumor occurred, gray mice were found to be susceptible, although in less degree; but all efforts to transfer the growth to other varieties of mice, to white rats, guinea-pigs, rabbits, and goats were unsuccessful. It appeared that the growth of the tumor in the inoculated animals was dependent upon a true transplantation. for if the tumor cells were mashed by grinding them in a mortar before the inoculations, the experiments resulted negatively. No evidence was obtained which watranted the assumption that the growth was of parasitic origin. Observations made to determine the viability of the carcinoma cells when subjected to different temperatures, light, etc., showed that positive inoculations could be obtained with isolated portions of the tumor which had been kept at from 1° to 3° C. for eighteen days, and at room temperature for twelve days, while at body heat the tumor cells became inactive after twentyfour hours. At a higher temperature the tissue was rapidly killed. All inoculation experiments were negative with portions of the growth heated for five minutes at 47° C. Intense light likewise proved very destructive to the cells, although it apparently penetrated but a short distance into the pieces of tissue. Partial drying was injurious, and a } per cent. carbolic acid solution caused death of the cells after a period of five minutes.-W. T. L.

The Action of Bacteria on the Hæmoglobin of Blood.—Lobbe (Arch. de mêd. exp. et d'anat. pathologique, 1903, xv. 364) has found that both pathogenic and non-pathogenic bacteria act as reducing agents when grown in contact with bæmoglobin or oxyhæmoglobin. Their action was found to be of two distinct kinds. Gradual reduction and transformation of hæmoglobin into methæmoglobin was apparently caused by secretions from the bacteria, for such reducing substances could be demonstrated in filtered toxins from the bacteria. The nature of the changes in the hæmoglobin varied according to the species of bacterium used, and the substance produced by the bacteria was, therefore, considered as more or less specific. On the other hand, the marked reduction of oxyhæmoglobin into reduced hæmoglobin appeared to

be intimately associated with the life of the organism. This process was brought about by an intracellular combustion, the bacterium absorbing oxygen from the oxyhæmoglobin and thus transforming the latter substance into reduced hæmoglobin. This property should not be considered as specific, but common to all bacteria as well as to all living cells. believes that these results offer an explanation for the changes in color of the blood in severe septicæmia, for it appears not improbable that small amounts of methemoglobin and reduced hemoglobin may be formed in the body when large numbers of bacteria circulate in the blood. De Ruyter has already found certain spectral bands in the blood from cases of malignant edema which are nearly identical with the bands formed by methenioglobin, though they show some minor differences. The formation of methemoglobin in the blood would ultimately lead to the most important consequences. more and more hemoglobin is reduced to methemoglobin, there would finally result an asphyxia of the cells of the body. Such alteration, according to the author, may be offered as an explanation for the mechanism of death in certain cases of septicæmia where there is no mechanical cause to explain the phenomenon.-W. T. L.

An Improved Method for the Microscopic Diagnosis of Intermittent Fever.—Ross (Lancet, 1903, vol. clxiv. p. 86) uses a thick smear of the suspected blood, containing at least twenty times as many corpuscles as the ordinary preparation. When this smear is not fixed, but stained immediately with aqueous eosin, the hæmoglobin is dissolved out, leaving only shadows of red corpuscles. A counterstain of methylene blue brings out the parasites clearly. In cases with a few organisms the time saved by this method of staining is very considerable.—F. P. G.

Bronchopneumonia with Whooping-cough.—Joachmann and Molatrecht (Zentralb. f. Bakt., 1903, xxxiv. 15), in twenty cases of bronchopneumonia in Eppendorf following whooping-cough, three of which were fatal, found an organism resembling the bacillus of influenza, which they named Bacillus pertussis Eppendorf. This organ was isolated in pure cultures from the lungs of the fatal cases and from the sputum of the other cases in the convulsive stage. The bacillus is regarded as the specific factor in whooping-cough by the writers. It grows only on media containing hæmoglobin, and then with difficulty and as discrete colonies.—F. P. G.

On the So-called Invisible Microbes.—Roux (Bull. Pasteur, 1903, i. 7 and 49) says that as early as 1881 Pasteur suggested that rabies might be due to a microbe which was so small as to be invisible in ordinary microscopic preparations. Since 1898 several diseases have been studied, some of which are unquestionably due to microbes too small to be within the limits of the present-day microscope. Among these may be mentioned "aphthous fever," "peripneumonia of cattle," "horse sickness," "bird pest," "cattle pest," "yellow fever," and "sheep rot." Serum from animals dead of any of these diseases will, when diluted and passed through Chamberlain bougies, give a filtrate which, while free from visible organisms, may show a slight cloud in

bouillon cultures, and will in each case produce the typical disease. In the case of peripaeumonia of cattle, by giving the organism intraperitoneally in collodium sacs, it has been possible to bring it to a size that is just visible with the highest power of the microscope. Small colonies of the same organism were grown on a special agar medium.

The problem in connection with these small organisms seems to lie in the line of the discovery of media suitable for demonstration of growth. The probability of the further perfection of the microscope is doubtful, but microphotography may avail somewhat in the settling of these questions.—F. P. G.

Pemphigus Vegetans.—Hamburger and Rubel (Bulletin of the Johns Hopkins Hospital, 1903, xiv. 63) review the somewhat confusing literature relating to the varieties of pemphigus and report a fatal case of the form known as p. vegetans. The mouth and almost the entire body of the patient were covered with bullous eruptions and excoriations. At autopsy a firm, nodular, white mass was found in the anterior mediastinum which consisted of lymphoid connective tissue. The organs otherwise were normal. Cultures from the mouth and the heart's blood gave pure growths of a small bacillus which seems to belong to the pseudodiphtheria group. This organism is pathogenic for rabbits and guinea-pigs when injected subcutaneously, and is regarded by the writers as the etiological factor in the production of the disease.

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DR. FRANCIS R. PACKARD, 1831 Chestnut Street, Philadelphia, U.S. A.

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